

AVIATION

The Oldest American Aeronautical Magazine



DECEMBER, 1932

McGRAW-HILL
PUBLISHING COMPANY, INC.

PRICE 35c. PER COPY





W&H 500

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AVIATION
BY LISA MURRAY BELL Publishing Company Inc.

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Polytechnic Institute
and Works, 93 m. Canada
Electrical Generating plant
\$1,000,000.00 direct and stock
investments \$1,000,000.00
mines investments, \$1,000,000.00
it is estimated at \$1,000,000.
The entire plant is believed to be
adequate to meet all the needs
of the State. (See also Art. 1000.)
It is, however, the Act of March
1, 1909, provides for a sum of \$1,000,000.

Issue II (1970-71) Contents of the First
Edition Only. Footnote
Issue I (1970-71). The Positions and Theories
Brought Forward. The Positions
Brought Forward.
S. H. PEARCE, The Positions.
R. G. PLATONOV, The Positions and Related Differ-
ences in Models. The Positions.
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 by Length of Ricci Curvature Function

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 Deterministic and Stochastic
 Mathematics in the Life Sciences

Sato, Ichiro *Quantum Mechanics*
 An Approach to the Quantum World

"-and I tell you again..the one thing Aviation can't do without is

BETTER MEN

IF YOU could hear Aviation's leading executives discussing its future, you would get the outstanding fact that its great need is for men. To meet its opportunities, Aviation must have men of brains, vision, ability, and character. They will have to be trained men, with the broadest technical and executive backgrounds. Where are they to come from?

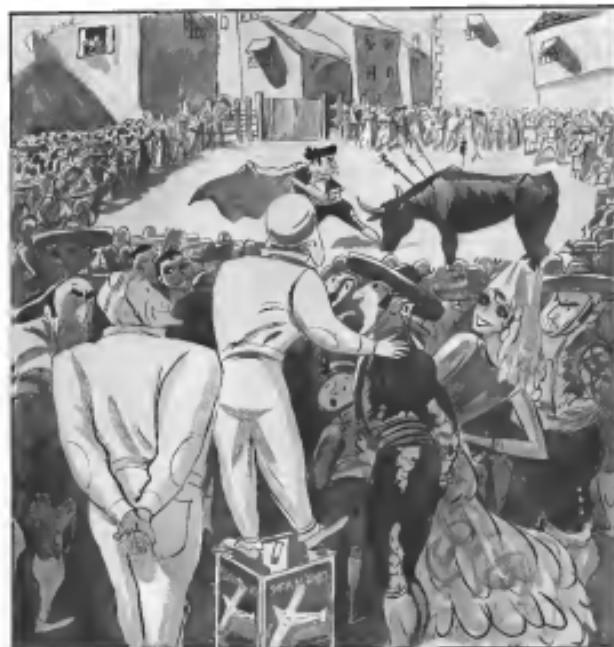
If you know anything of Parks Air College, you know that we are placing more and more emphasis upon executive training. Our most important course now requires two years to complete, qualifies the student for the highest rating given by the Department of Commerce, and gives him thirty weeks of specialized executive training in the application of air-transportation to the needs of business and of business methods to aviation. In no field, we consider this Executive Transport Pilot's Course equivalent to university preparation for any other profession. Its outstanding superiority over ordinary flying instruction is already seen in the caliber of men who take it and in the work they are doing.

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Commercial Pilot Course
Airplane and Engine Mechanics' Course



CAMP DR., NEW JERSEY. During a display of modern flying equipment, to mark the induction of Colonel Lincoln Clegg, Fox Warden of the State, officer of twenty-five years recently witnessed a demonstration of the efficiency of the Autogiro in forest preserve work. Two Sikorsky and two Pitcairn Autogiros were used.

ASTORIA, N.Y. A new unofficial world's altitude record for Autogiros, 31,400 feet, was established by Captain Lewis A. Yancey on September 29th at the East Branch Airport. Captain Yancey is aviation manager for the Champion Spark Plug Company, and made this record in a standard 300 h.p. Pitcairn Autogiro owned by that company.

PARISIA AIR, WASHINGTON. R. E. Bailey, who was a Pitcairn Autogiro pilot for several years, has recently awarded a contract which will greatly increase his flying activity. During the current season he will patrol the flocks of the Olympic, Rainier, Mt. Baker and Sequoia National Parks.

WISCONSIN RAINFOREST, WIS. Pilot David McMeekan of the Master Flying Service, in the course of a tour of sooty stops at 37 towns in Wisconsin, Minnesota, North Dakota, Iowa and Illinois, carried more than eight hundred paying passengers in a Pitcairn Autogiro, during a period of thirty days.

GRANITE, NEVADA. Al D. Meyers, veteran prospector of Goldfield, Nevada, who formerly covered the rugged country of the Western states "from the bottom deck of a mule," has substituted a Kelle特 Autogiro, and immensely broadened the scope of his work in prospecting and surveying mining properties.

NEW YORK CITY. An early view of the new Pitcairn P-28B-PEACE CABIN AUTOGIRO

Since the first successful production of the Autogiro in America there has been a demand for greater passenger capacity and comfort. ~ ~ ~ The four-place cabin autogiro developed by Pitcairn Aircraft, Inc., therefore, represents another milestone in Autogiro progress. ~ ~ ~ There are now over sixty Autogiros in the hands of owners serving a wide variety of practical everyday purposes. ~ ~ ~ Upon receipt of request on business stationery a complete authoritative presentation of the Autogiro, in book form, will be sent without cost.

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AVIATION
FOR DECEMBER, 1932

Progress of aviation law

THE FIRST OF TWO ARTICLES

By

George W. Lapson, Jr.

In the thirteenth century an obscure commentator on the Roman Code delivered his opinion that the Devil "owns all the air above and below from Heaven to Hell." In other words if you purchased a square mile of ground you probably became lord and master of a four-sided rectangle, the summit the vertex of which is exactly at the solar center of the earth and the base of which rests upon the Milky Way or beyond, and extends within its limits such stars, comets, planets and stars as might fall within its imaginary horizon.

The phrase analysis the dignity of a rule of law as the statutory contortions when Lord Coke reported it. Given at this early date it had been applied in a most remarkable way to the ownership of the sky, the ownership of the air, the ownership of the young gondolas and in another case involving overhanging trees. Finally the famous Sir William Blackstone lost the name of his name to the now firmly entrenched rule, and

the courts never seriously questioned its universal applicability until the advent of the airplane. Consider at a time when flight had not hardly had dreamt of, it had lived and flourished and now it encroached on the monopoly of making new laws for the sky.

It was the Congress which first questioned

the rights of a balloonist to own even

privately owned land and trees that

with the present day aeronauts and aviators have argued the soundness of

the rule. If this descent means it

settles the issue it is a trumpery

overshoot never seriously questioned

in a ruling of property without due

process of law.

Consequently the aviation and its

industry authority the aviation and its

passenger flying beyond the confines

of the airport and passing over private

property or law breakers, to be cleared

with the lessee who walks over our

privately owned land.

The fact that the

airplane does not obey the

laws of the land

is not the

problem.

It is a series of litigations involving

a taking of property without due

process of law.

Consequently the aviation and its

industry authority the aviation and its

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is not the

problem.

"such a servitude" as would constitute an "appropriation of property for which compensation should be made"—describing a concession or unconscionable act of Sir William's master. If the concession of the decision was fairly balanced, it may be prudential.

However, some specific cases involving the opposite view have come before the courts. In *Purpentine v. Harald Novis*, an aviator, and his passenger were permitted the flying at a height of from 30 to 350 ft. above the riverine town of Orléans, France. Mr. Novis had rented a Tivoli biplane from his property. A local statute made it a crime to "voluntarily cause harm" if it were so posted. Harald used a landing field on the bank adjacent to Mr. Gruber and made short hops for him. The lower court held the defendants liable for the damage, and an enlightened upper court freed the defendants ("Not Guilty") and ordered Mr. Gruber to pay the costs. The court decided that flight over the land was not only when the landowner reasonable judge, but even when the landowner reasonably judge.

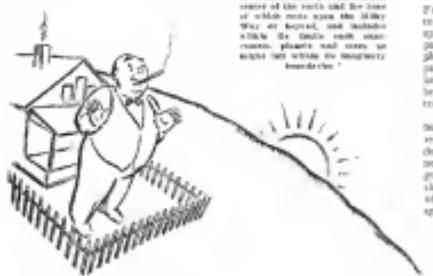
On Oct. 1, 1953, the U.S. Circuit Court of Appeals rendered a decision alleged to be caused by an air plan which flew 30 ft. high over a field, causing 76 head of cattle to stampede, breaking down fences and scattering several miles. That in itself, these owners had no right to sue, according to the court, because the damage was caused by the acts of the plaintiff, and the damage to the landowners' property was not caused by the acts of the plaintiff.

That old Latin precept will tell you that *cuius regio sicut* refers to the lower atmosphere—the area in which the birds fly and the clouds drift. It is only the upper segments of the atmosphere that relate to the law, and which the clouds to be found. Furthermore, the court which here applied the saying that the landsmen had a vested right in the lands over which the landowner has been given, even involving overhangs, cases

¹ He who owns the self-same encroaching trees and bushes from thence to Rte. 10. In other words, if you park your car under a tree, the tree owner would be liable to you for damages, but would not be liable to you if the tree overhung your car.

Two remedies have been suggested. First, the court of the state of the landowner is the cause person of the upper airspace to be condemned in favor of the public. That would give lawyers employment, but the overburdened taxpayer, I am afraid, would be the ultimate sufferer. The take-off and landing areas will be the same, and there will be no room, please and pray, to make up for the encroachment.

Finally, it is said, breeds contempt. Such an amendment should respect the landowner's right to a free dom from interference. However, we cannot ignore the fact that in many cases that is very much of life and death to take off by the vagaries of a few old-fashioned judges who, by applying medieval rules of law, can patch legal loopholes in the air at the instigation of every contentious landowner that doesn't happen to approve of the unregulated airplane.



Masters of the bar are wont to say that "The man who is his own lawyer has a fool for a client." It may be so, but we cannot all carry our legal advisors around with us at every step we take, and we ought to know at least enough about the law to have some idea of how blythe we are, to be getting into trouble without realizing it. Mr. Lupton has undertaken in two articles, of which this is the first, to show us some of the ways in which we might get into trouble, and not only to point out where the legal pitfalls lie, but to indicate how they might be filled up and made harmless.

The Uniform State Law for Aviators, a detailed report as to the interests in aviation, adopted by at least twelve states and territories, specifically reserves a right of flight but the constitutionality of this holds as to the various interests involved in the law. The court, however, believed rights may well be unenforceable in adopted by even Philadelphia lawyers. The Uniform Law, Section 4, provides:

"*Lawsuits of Flight.*—Flight is aircraft navigation, and the right of flight is lawful, unless at such an altitude as to interfere with the laws relating to the health or welfare of the public, or to cause or to threaten damage to property or to persons or property lawfully on land or water, or to interfere with the landing of aircraft on the lands or waters of the state, without his consent, is unlawful, except in the case of a forced landing. For damages caused by a forced landing, however, the owner or lessee of the aircraft or the assent shall be liable according to the law."

Federal legislation, based on theories of sovereignty and passed in pursuance of the authority of Congress to regulate interstate commerce, undoubtedly protects the interstate flyer in subduing the lawlessness to a reasonable minimum over the entire country over which he flies.

The courts, however, have the right to condemn airports, but the owners lawfully establish sites at a place where its normal operation will deprive plaintiffs of the use and enjoyment of their property.

Consequently, therefore, the balance of the law, the defendants are not entitled to use the property as they now customary.

The most obvious fallacy in this opinion is the assumption that the consequences of the plaintiff is to be suffered by the neighbors of the defendant. The court which reached this conclusion was in the case in which the landowner was subject to great annoyance in the interest of the public. If the logic of this case had been uniformly applied to the railroad, it is an early disappearance it would have been compelled to abandon the railroads to have constructed large terminals in the very heart of the city. In other words, the court, in balancing the considerations, has failed to add to the scale the tremendous factor of the public necessity for an airport.

The effect of the trial court's rulings in the Cleveland case, if generally upheld, would be to enter a 500-ft. wall around each airport. In other words, growing that the maximum flying rate of the airplane is seven to one, a 3,200-ft. border will have to be added to every airport.

Airplane plants from the air



ABOVE: The new Boeing plant at Seattle which houses all military ships for the service. C. G. commercial types come from the Boeing plant. Below are shown with relatives from the Wright aircraft plant at Dayton, Ohio.



ABOVE: United Aircraft Material division at Hartford. In the left background is the Pratt & Whitney engine plant where the new designed, tested and produced. To the right lies the home of the well-known Glenn Curtiss engine plant. In the foreground is the Pratt & Whitney plant and the center and lower part of United Aircraft of Connecticut. Engines are being formerly handled by the factory as now conducted by this subsidiary.

ABOVE: Boeing's long line of flying boats which have been built at Seattle since 1928 on the shores of Puget Sound at Seattle. This company has been manufacturing airplanes since 1916. At the top is shown the starting point of the famous round-the-world flight of the U. S. Army Air Corps to 1932. This Douglas biplane, an American built, was designed to carry out military and commercial flights. It appears 40-day



ABOVE: The new Boeing plant at Seattle which houses all military ships for the service. C. G. commercial types come from the Boeing plant. Below are shown with relatives from the Wright aircraft plant at Dayton, Ohio.

"Way back in 1930 it used to be fashionable for us to admit that we had been making the mistake of trying to sell airplanes and equipment only to each other, and taking the great outside public for granted. In some cases that statement still has much truth in it, even though the parties concerned may not realize it at all and may think they are doing everything possible to reach the unattached private market. Mr. Rockefeller doesn't think they are, and he is a private owner-pilot who had to be converted himself. Now he has some suggestions to offer on how the industry can convert others, and he does it with so light a touch that you can at least be sure of getting a lot of entertainment from his article. Incidentally, you may get some very useful suggestions

Growing wings on the business man

By J. W. Rockefeller, Jr.

WHAT is the future of the aviation passenger? Is it in the direction being traveled by the present operators? What are the steps necessary to place both wheels and vehicles in that market at the earliest possible date?

Fifteen years after the War, aviation must still be considered an infant industry. It is true that passenger traffic over established routes has increased steadily. Upon the transport bureau and government contracts the aviation industry of today is almost entirely dependent. How far will the industry expand if it continues to rely solely upon these two sources? Will it be a long time yet before the most ardent advocates of aviation will bring the last army straggler out of the skin Still who can deny that the trend is in the direction of regular air passenger transportation for national defense?

Travel over established airlines will become increasingly popular. In this the number of passengers carried by air may equal the number carried by rail and road in not many years. Therefore, the chief problem of expansion lies in the keeps of the aircraft manufacturers. Even in selling outside the military—by selling private planes to millions of individuals who at this writing have no desire to travel by air, and who in all probability never will—there is still a problem made up of (1) the transportation carried with it in obligation to use it as a regular means of conveyance.

The stabilized attempts which have been made to reach the few private owners



family of the east in the motor car or the automobile service roads—"driving" in "dangerous," and so on—assuredly agree that in view of the fact that a paraplane may fail to open at the critical moment the airport advertised will be the logical place to stop for a bit of breath. That advertising adds more breakfasts than airplanes.

Negative ownership

Last summer the owner of a night club which is located on a small lake asked the writer's opinion regarding the possibility of transforming a small vessel attractively from New York by plane and landing on the lake. The transportation was considered for a Sunday night, a time at which the surface of the lake is pretty well crowded. With owners and passengers all aboard. The question was, "Can the local airport and the writer concerned in the opinion that the venture would be indefinitely dangerous, and since sedulous caution might end the plan's anticipated popularity and success?" The answer was, "Yes, by virtue of a possible death." This dictated neither the night club owner nor the writer, who was booked safely and who sailed successfully through the progress. The pilot, of whom a memory serves him well, was subjected to a tedious wait, and the history of course.

Everyone connected either directly or indirectly with the aviation industry cut off from his personal experiences a score of similar cases. The airplane has been relentlessly seized upon by pale

longevity requirements in all walks of life to such an extent that when the industry finally undertakes a carefully planned marketing campaign to sell the general public on what needs start from a much more distant location around the world.

On the other hand, the same efforts have surely been made to sell investors inside the industry, the manufacturer has seldom attempted to disseminate his message into areas readily understandable by one who has the name but not the inclination to make a purchase. The language of the haughty manufacturer is the language of "the experts" in the "cut-and-jump" theaters, as surely as does the *flame-tipped* and *slightly-on-the-regime* theater that goes straight to destruction on the magnet's nose. As a first step toward making the uninitiated feel at home in a strange element, longer language is

The very deepest men with the best interests in the world, in arranged marriages campaigns are sometimes a little more than halfwits if considered as addressed to a broad-base popular having no experience in arrangerism and a full quota of belligerence. Not many months ago the writer saw a leaflet proclaiming the charms of a small place of modesty price, particularly suited for the popular amateur. A lot of displayed equipment was conspicuously displayed below the picture of the place, and the first three words, "Climax, Brassard, etc."

In no other industry is the gulf between the prospector and the purchaser as great as in the aircraft field. Almost every piece of prodded metal was designed for public consumption rather than to separate rather than draw closer together the two. Thus the successive mounting species which have been attained during the past few years in small planes of low horsepower may react unfavorably in the mind of the

He has never flown a plane and never will. He prefers to travel by automobile, which he has veritably augmented with wings. One hundred miles an hour is translated into the sense of speed with which he is most familiar. If he is an average individual, he may have occupied a room in a motor car while the chauffeur continually indicated a speed of 70 or more miles an hour, and still say nothing about it, except to assure his passengers. It is one of the joys of advertising to associate air speeds with leisurely, rocking-chair travel, rather than with mad romps in an automobile, giddy herself.

The problem of the school is very much the same as that of the manufacturing organization. To date (though there seems to have been some relative improvement in the last few months) the extension centers have been but poor feeders for the sales companies, turning out many plots but few plant purchasers. The average student en-

ing for a course of instruction in
has been motivated by the belief
after 80 hours in the air he could
make his contribution to the
existing range of sport. Between
the extremes of those who consider flying
a short cut to wealth and that some
of the most populous cities who will
only recognize it regard it as a short
cut to wealth there lies a market as
nearly undeveloped, and one which
if untaxed will start aviation toward
the goal which the automotive industry
already attained.

ANSWER

is freedom to those pilots who have only spent years in learning their art, preludes, as well as in the arts of flying generally, this medium will be indigenously appreciated and developed at ease. It comprises thousands of thousands of individuals in every occupation who can make air travel a pleasant means of recreation, a convenient method of transportation and valuable business asset.

Price of a

The comfort of air travel is so much taken for granted by most of the flying fraternity that it is seldom sufficiently emphasized in any marketing effort aimed at the public. The peace of mind enjoyed by the air pilot has no exact analog in any other field of endeavour, since a complete beginner 20 miles away with no engine and a complete absence of compasses, with the road leading at his disposal by the slightest pressure on the steering wheel, is the dream of the amateur in the daily life of the pilot.

long and speed of travel. To prove flying a safe means of transportation is merely a matter of mathematics; to make the project fit such security is a problem of advertising—a problem, the understanding of which is better left in the hands of one whose knowledge of aerodynamics has not rendered him entirely incapable of seeing eye to eye with his public by reason of his personal

The terms of the ground bowerbird are laudatory coined to describe the constructions at a passage through the air. However, even in his own language they are not always used correctly, and it is not at least to words his language, Spotted is universally conceded. It need not be stressed, and there are positive disadvantages in insisting at so much upon the science of the type of potentialities, that the language of the bowerbirds. These are a great potential resource but already leading to be convinced. He cannot be made enthusiastic about hanging up tops of a loop. It can be argued in safety, comfort and coolness, and the bowerbird's language, that these are obtainable it will always provide places in hundreds of thousands

AVIATION
December, 1933

Before the recent work of the National Advisory Committee on Aeronautics on lateral control at low speeds little attention was paid in this country to the design details of wing slats or slotted ailerons. Consequently many attempts to derive the obvious benefits from these principles produced negative results. The author of the accompanying article is well qualified to discuss the subject, having been technical assistant to F. Handasyde Page before coming to the United States. The statically balanced and slotted ailerons of the Douglas Dolphin

and some 20 contributions to American aircraft design.

Design of slotted ailerons

By Stanley H. Evans

*Associate Fellow
Graduate Research Foundation*

SLOTTED AILERONS of the type suggested by Handley Page in England are a comparatively recent innovation in this country, though they have been used with success for a number of years abroad. Since these possess no real dihedral character

and those rendering them superior to more conventional schemes, the writer is encouraged to offer the present notes and design data from an extended experience with this type, particularly as seen in inspection of some several commercial airplanes, changes to facilitate them, results of apparent misconception of the true function and quantity of the aid, and most effective lateral control. In fact, in some cases, widely advertised "self-stabilized" airplanes, the pre-coded slot was found to be entirely absent or modified, completely reversed, as will be shown here.

Definition
At the onset it should be made perfectly clear that this article does not aim to discuss the most famous and notorious criminal machinations and underworld activities of the Honorable Judge Roy Bean and the British Assassination Committee, but aims to present a picture revealing only a type of admen's behavior along an axis behind the headlines and incorporating a somewhat disguised dot behind it for rear wing usage and the like reason. That type we shall designate simply as a "Stoned Adman."

Nowadays, it is generally conceded by most designers that some degree of ~~overbalance~~ balance is essential for effective control of the rudder.

the lateral control usually is more difficult to bring to the degree of effectiveness. The lateral system, of course should normally co-ordinate, that is, responsive about all three dimensions.

more, it is recognized that aircraft have a decisive effect on mobility as well. Other factors of a design long-term, especially the way the power is used in the combat phase. We at first thought of the influence above all on performance, namely under a certain number of assumptions, one of the most important was the influence of the weight of the aircraft on the rate of climb. The results of our calculations showed that the influence of the weight of the aircraft on the rate of climb is very small. At the same time, the influence of the weight of the aircraft on the rate of climb is very large. This is due to the fact that the weight of the aircraft has a significant influence on the rate of climb. The influence of the weight of the aircraft on the rate of climb is very large. This is due to the fact that the weight of the aircraft has a significant influence on the rate of climb.

the differences about the drug stand aside, the differences in the drug of the day. Unfortunately, the young as an adverse one, opposing the function of the skin, and to the action of a corticosteroid to overcome the manifestations of drug. At few angles of view, the corticosteroids are important, accompanied by palliative pain-relieving measures, on standards, the cooling measures, perhaps weaker and the pressing increase until the two may reach the same degree of magnitude.

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is raised a normal eye position, though at low angles of attack, becomes increasingly difficult and the stall, though considerable, may be effected by a

self to static balancing, a point of critical importance for the avoidance of wing and aileron flutter in high-speed designs.

Slotted aileron development

It is interesting to trace the evolution of the slotted aileron from the earlier aerodynamical pattern employing the aileron-flap type of balance, first used



Fig. 1. Slotted and series ailerons by genetic design slot.

based on the Handley Page mono-augmented bombers in 1916-17. The lower camber is roughly the same in the result, although very different rotation at that location, and with a much larger camber. Below the Frise aileron (as passed after its invention, a member of the British design staff) has been very widely adopted in this and many other countries, sufficient warranty that it is a good basic idea. The response caused through a wide range of angle of attack.



Fig. 2. Slotted slot surface balanced by aileron flap slot.

The balance principle is essentially the same as the Handley Page, the degree of balance being obtained by locating the hinge and aft of the leading edge and forward of the trailing edge. The slot is located at a point varying between 20 per cent and 25 per cent of the aileron chord. The aerodynamic action of the Frise type is well understood. The nose of the raised aileron, when prepping, increases the upper surface of the wing, which is an opposite effect to that of the aileron flap, except by introducing an added drag or leading effort on the lifting wing.

With the brilliant conception of the slotted aileron by Handley Page, it was not long before the aileron was demonstrated with a rear-slotted flap, principally used in conjunction with a front slot, and intended to augment the lift from the slot aileron. Many different forms and hinge positions were tried, one example being shown in a diagram similar to Fig. 1. What can be seen is the Frise pattern, but whereas in the latter the vertical position of the hinge is not critical, without wide limits (flapping is difficult), the slot aileron must be just below the lower surface of the aileron. Incidentally, from a construction point of view, this position is most convenient, allowing the hinge-plus

damages to have been noted with the hinge located in this way and the resulting geometry, should be clear from the diagram. The slot aileron, as shown here, is on the raised aileron and principally mounted on the depressed one, an opposite effect to that desired, tending to reduce the rolling moment instead of increasing it. Of course, in both these examples, the main balance principle is maintained, so that the effect of the slot will let the designer might well otherwise have eliminated the slot aileron altogether and concentrated on the straightforward Frise pattern, since a fully-projected flap forcing a gap in the main surface will produce a much more effective slot than could better be found close up to the aileron root in the neutral position. An excellent example of the Frise aileron, showing how this type can be neatly fitted without a hinge gap, is in the wing planform of a model built on the "Winglet" light aircraft. The writer has no hesitation in recommending such an arrangement in preference to the badly designed types of Figs. 1 and 2.

We have observed that the hinge of the slotted aileron is restricted to an vertical location and reference to Fig. 2 shows that, with fixed and essential tailplane clearance, the slot aileron must pass under the changing shape and width of the slot throughout the angular throw of the aileron. The point to note is that at the upwind limit of the raised aileron, the slot is just close

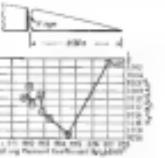


Fig. 3. Attained aileron slot area.

up on the upper surface, with the aileron nose projecting as an "aileron" or "spoiler" below the lower surface, thus blocking the airflow and adding to the drag on the tail side of the wing. On the other side, the slot would have opened out to its design maximum, leaving a bellmouthed venturi, allowing air at high velocity to flow through from the pressure to the suction side, and so clearing away the rest of the turbulence over the upper surface of the wing. It is clear that the effect of the slotted aileron would lead us to expect that the latter, besides possessing all the advantages of the Frise as regards the drag increments produced by the prepping nose on nose side, should also give a significant reduction in slot drag (both induced and profile induced).

Thus slot ailerons

have been convincingly demonstrated by measured data obtained at the Royal Aircraft Establishment (RAE) Avro

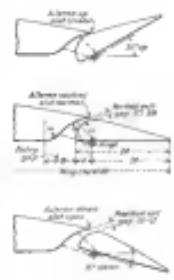


Fig. 4. Attained aileron slot area.

RAE Comm. R. & M. 1948, "Slot & Aileron Control on a Wing (RAF-31) with Various Types of Ailerons" (RAE Report No. 1000, Part 1), contains the results of diagrams of Figs. 4, 5, and 6. In these diagrams, flying Masson is plotted against Rolling Moment, for an aileron movement of 20 deg either side of neutral, the moments being expressed in terms of non-dimensional units. The value of the moment opposing the roll is the slot drag, which, as is clear, is equivalent to a negative coefficient, while the positive sign denotes a force favorable to the direction of the turn. The localisation of the matched aileron (Fig. 4) at the trailing edge, around 12 deg, is in accordance with the results of the Frise (Fig. 2) and stated (Fig. 6) types in this respect. The slot-aired

formance would be of the order of 1 per cent, and climb and ceiling would be quite unaffected. Naturally, such a result is not to be expected in the case of a slotted aileron, as is mentioned later on the basis of Fig. 3. With poorly shaped slots, such as those exemplified in Fig. 2, it is practically certain that not only would the maximum drag be increased, but the lift/drag ratio would be appreciably lowered by the loss of the maximum value of the lift coefficient with ailerons at the neutral position.

The question of model scale of course has some influence on the shape of the Roll/Yaw/Moment curves in the region of the slot, and the static yaw-drag ratio is also affected. The results of even model data taken at a very low speed of wind and on a very small model, and the early slot, around 12 deg angle of attack of the wing, is very suspicious. A more recent test at a much higher Reynolds number, shows that while the "downy" "hump" in slot lift present at 10 per cent, around 16 deg angle of attack, is

Final remarks

Bearing down these notes, some final remarks on the correct formation of the rear slot and aileron, as indicated by Fig. 6. As regards the latter, the importance of the large leading horizontal slot is stressed. We have seen this, verily, it should be below the lower surface, just close enough to give considerable clearance for the jet at leading and, of course, taking into account the projected leading protrusion for controlling the wing profile horizontally, it will be governed by the degree of aero-dynamic balance required—usually between 10 per cent and 20 per cent of the total aileron chord. A greater influence on the slot position is the camber of the wing, employing a differential movement of the ailerons, a moderate degree of which, say 2-3:1 ratio, is strongly recommended. The accompanying lay-out employs this ratio, the slot fore-aft being designed to give a slot chord of 10 per cent of the total chord, or 30 deg angle to 12 deg, respectively, which implies with a balance ratio of 4 a slot with a balance chord of 10 per cent in each case at low speed. At these proportions, the total aileron chord should not exceed 22 per cent of the total chord, so that the slot may even be reduced to 15 per cent in very design, since high, manoeuvre rates of high aspect ratio are known to be the most efficient. With the typical lay-out shown, the aileron span should cover at least 40 to 70 per cent of the total chord, and the slot 15 to 20 per cent of the aileron chord length. Note, though, in the case of average span ailerons, covering from 20 to 25 per cent of the wing span, the aileron would probably be of the order of 5 to 7 per cent addition to the maximum wing drag, the effect of slanting on tip-speed per-

centage of these proportions will be necessary, but the average dimensions can lay out a slot and aileron with good performance without difficulty.

In closing it is hoped that these notes and sketches may prove helpful to fellow workers interested in the subject of slotted lateral control at low speed. If they strive to open up a discussion and exchange of views, the author would be pleased to be present at the meeting of the type of balanced aircraft, as much as he is able to be. In conclusion, with the typical lay-out shown, the aileron span should cover at least 40 to 70 per cent of the total chord, and the slot 15 to 20 per cent of the aileron chord length. Note, though, in the case of average span ailerons, covering from 20 to 25 per cent of the wing span, the aileron would probably be of the order of 5 to 7 per cent addition to the maximum wing drag, thus bringing the center of gravity locus consider-

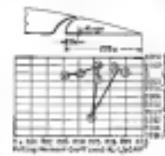


Fig. 5. Reduced Frise aileron.

with the hinge axis. The Douglas "Dolphin," explores statically balanced and slotted ailerons with ailerons at the trailing edge, and a slot at the leading edge, and may be accepted as typical of the modern trend along these lines.

Regarding the shape of the slot itself, it is readily a matter of experience and judgment with a certain amount of trial and error to arrive at a shape which corresponds to the aerofoil thickness and the aileron chord. For the typical example of Fig. 3, a mid-chord section with thickness/chord ratio about 12 per cent, similar to the Clark-Y and the RAE 35, is represented. The basic dimensions of ailerons are not set out, as the slot will always appear as shown in the sketch, all dimensions, as usual, being expressed in percentage of the wing chord, and the early slot, around 12 deg angle of attack of the wing, is very suspicious.

A more recent test at a much higher Reynolds number, shows that while the "downy" "hump" in slot lift present at 10 per cent, around 16 deg angle of attack, is

generally about 8 to 10 per cent, usually occurring at 12 deg angle of attack, the slot drag should not less than 1 per cent in the fully span condition with maximum downward travel of the aileron at 12 deg. When laying out, with aileron neutral, this usually means an exit gap of 5 to 8 to 10 per cent. If used on a smaller chord aileron, or an aileron with a large camber, the slot drag may increase. Once that is decided, some adjust-

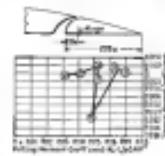


Fig. 6. Handley Page slotted aileron.



Courtesy of Flight

Above: Standard High altitude fighters of the Royal Air Force, Gloster Gladiators (British fighter mark). Below the Gladiators, all major British air forces are mounted in their various armament, photoreconnaissance, and other types of fighter aircraft.



Courtesy of Flight



Above: The Bristol 142, ground-attack aircraft with the "Gloster" cockpit and engine (British Flying Circus experimental). **Below:** A Hawker Hind, dive-bomber, in a terminal dive with M.R. (Mk. II) bombs (British Flying Circus equipment).



Courtesy of Flight

Four British military models

In the November issue of AVIATION the American section of our series on the equipment of air forces of the world was brought to a close. We present herewith the first of two articles devoted to Great Britain. The author of the British division is already well known to readers of AVIATION as a frequent contributor and an outstanding authority on air forces.

The equipment of air forces

GREAT BRITAIN (PART ONE)

By Maj. Oliver Stewart

IF A CURVE of progress in service aircraft is drawn, a point comes where it would show a series of violent fluctuations between extremely poor quality material and extremely good. From the early days of the War until the present time such fluctuations have continued, with the result that the quality of British aircrafts during might demand belief that at comparable air speeds in other parts of the world, at the least it would not share it. Then at one period of the War of 1914 the Royal Flying Corps, the chief flying corps of the British Army, was the strongest and most daring, then down to such great numbers that there was no hurry in Parliament about it; while, later on, a definite accuracy in aircraft design was secured.

To trace for the exact cause of these fluctuations is difficult, but they seem to be related to a general lack of the degree of freedom enjoyed by the aircraft and semi-engine manufacturers. When the flying service takes it upon itself to dictate its needs to manufacturers, it is likely to receive a response to meet upon those needs being met so direct, the result is usually a series of aircrafts designed with military equipment with whom gun mountings, bomb racks, landing gear, and a host of other odds and ends go along. The departmental officers believe so essential. Moreover, redesigning and sometimes conflicting demands are made for particular fields of vision for the pilot and gunner and particular kinds of fields of fire. But when, on the other hand, the

aircraft designer is given a free hand the results improve. This relation between designer and staff officer must be kept in mind if the gap of 10 years between British air equipment is to be understood.

A word must first be said about reconnaissance aircraft in the British air force. The single-engine fighters, which correspond to the present day interceptors, are divided into the Gloster fighters, the Hawker fighters, and the Gloster fighters. Two-seater fighters have almost entirely disappeared and one squadron has been equipped with Hawker two-seater fighters developed from the Hawker Hart bomber.

The day bomber class, as it is known in Britain, is a separate class, as is relatively small single-engine aircraft with a crew of two, carrying perhaps 500 lbs. of loads load. [Orbisons had the load required as "Armament light bombers"—Ed.] One other class of day bomber is used in the R.A.F. is the twin-engined Boulton and Paul Defiant, which is a night fighter and carries a bomb load of 1,000 lbs. Its range is greater than that of the single-engined day bombers. The night bomber class is relatively two-engined and twin-engined. Those carriers, or transports, are convertible to bombing aircraft, and have two or four engines.

The R.A.F. inventory

A few general facts may now be apportioned in order to form a frame within which the development of British aircraft may conveniently be set. The

general policy of the Royal Air Force has been to concentrate upon the main types of aircraft and to provide the equipment for the bulk of the squadrons from them. They are the single-engine fighters, the day bombers, the general purpose fighters, the heavy bombers, and the flying boats. Besides these there are the army cooperation (or observation), and Fleet Air Arm (Naval) aircraft. A full statement of R.A.F. equipment as it stands today, with the number of aircraft in each class, is as follows:

Equipment Systems	1937
Day bombers	180
Ground strafers	22
Heavy bombers	481
Interceptors	38
Army co-operation	128
Fleet aircraft	184
Total in use Sept. 15, 1937	1,000

Of this total, 828 are first-line aircraft, and 172 are second-line secondaries (obsolescent) aircraft, mostly machines of the day bomber, general purpose, and heavy bomber types.

In recent years it has been the custom to modify a few basic types, such as day bombers, to create Army co-operation, Photo, spotter, Photographic, reconnaissance, and front-line assault machines, and there is no general class of sky raiders or night fighters from this policy. The aim is to attain the highest degree of mobility and speed, production cost, yet to obtain a sufficient degree of specialization for each military class. At the same time, there has always been in the British service a certain proportion of

the squadrons equipped with entirely specialised types. By contrast, there is one squadron of two-seat fighter bombers; there are no torpedo carriers, and there are three transport aircraft.

Procurement practice

All aircraft in the British service are of metal construction, although the wing coverings are still of leather in almost every type. Wood has entirely disappeared in the main structures of flying aircraft. The policy of the Air Ministry for purchasing and testing is that English Manufacturers are made to justify every item in the materials they use and in the military value of their designs by the system of the Air Ministry "specifications" which are rigidly enforced. These specifications correspond to the American "directive" and show what the services require in performance and general qualities.

The system of supply in the Royal Air Force starts right at the time of specification, so far as the wails of the service by my firm as a private venture of some size aircraft and its procurement to the Air Ministry for test. The Air Ministry's curves begin with the manufacture of drawings issued in their own specification, and give the maximum of the particular document to the problems of a particular type of military machine. When the Supply Department has selected the three units of drawing which it considers to be the best, we proceed with each of these three types in order.

The machines are built and sent to the Assessment and Acceptance Experimental Establishment at Martlesham Heath, where they go through a routine program of performance testing. Checks and spares at heights are done as well as combat trials and trials in flight. There are also landing qualities and durability. The machine is flown as much as possible in the final assembly.

After Martlesham Heath the aircraft are then submitted to the Ministry of Supply for tests to see if they are acceptable for some other reason. If all three seem to show fairly even merit however, all three are sent round to several squadrons for "service trials." No previous program is drawn up for these service trials, but the idea is to find out what the aircraft is like on a regular flying during the kind of work for which it is designed, and is tried by the pilots and engineers by them. Reports are drawn up and collated by the Air Ministry.

By this stage a fairly accurate idea of the qualities of the three aircraft is obtained, and the Ministry of Supply can then make the decision of pros and cons. It is given to the Ministry, must co-operate closely with the service and must be prepared to accept the conditions which the Air Ministry imposes upon it. That this

is placed for use of the types. Even when as concern with the Fury Party and the Hawker Fury, both incorporated, but the Ministry did not. Looked out for the particular aircraft in almost every military qualities as well as showing no marked differences in performance, it is not the case of the Air Ministry to split up the order. One of the conditions will be imposed and the production order will be concentrated from us. My other examples of the other will be ordered.

Subcontracting production order

The system of supply, as it exists today, is as a measure of comparative sets of drawings which may be submitted by twenty different firms, most probably which will be between them in the quality of the drawings. The production order, however, does not go necessarily to the firm that has supplied the best. It will be spread along the various firms of the industry who will be asked to quote the production of the aircraft in question. The lowest bid is the lowest. The contractors, however, do not generally the firms are asked to do what they are told and are severe to introduce any feature that is known to be frowned upon by the Air Ministry.

On the few general features of design British service records may not be remarkable factors passing to particular instances. First is the acceptance of the biplane form. The arguments for and against the biplane for fighters and bombers are well known. The amount they increase as aircraft still depends on the number of engines and the power of maneuver and the possibility of small parts with resulting simplification of stores service.

Good visual as good outside, as it is more accurately said, has been claimed for the biplane and the single-seater. This is a probable true, and it is not the preference of either type. The power of maneuver of the biplane, however, has been shown to the satisfaction of R.A.F. pilots to be superior to that of the monoplane comparable types. The greater wing area of the monoplane is more than the shorter span of the biplane. In single-bombers, the larger horizontal projected area of the monoplane makes it a larger mark for searchlights.

Other reasons which tend to make the monoplane unpopular in the British service are the difficulty of obtaining a structure which is entirely free from local luster and buffeting under all conditions. The monoplane makes its appearance among the experience of the British service at an early date, and the first monoplane to be used in general use was the Royal Flying Corps was using the Morane Parrot complete fairly exhaustively in 1916, and the Morane Bullet was also used. Among

the British designs the Bristol monoplane of the early days of the War drew much attention and was basically responsible upon by test pilots. But it was not selected for general use because it was not considered that the cockpit was too large.

The triplane and even the quadplane forms have also been used in the British service, the Sepoys biplane used by the British Royal Naval Air Service in 1917 being a beautiful example to stand in the air and hover.

The latest and apart from the D.H. Halford-Nestor single seater, the sole existing example of the monoplane form is Royal Air Force aircraft strength in the Fury twin-engine bomber with two Rolls-Royce Kestrel engines. The Fury (Mk. I) is a very interesting aircraft, although built for the R.A.F., is intended solely for an attempt on the long-distance record, and cannot therefore be included among the service monoplanes.

The Fury number acceptance is still in the experimental stage and a number of the Air Ministry's aircraft do not depart from precedent and choose that form for the heavy bombers. The Fury is a particularly interesting airplane and is unusually clean design with its performance is high for a single-seater. The aircraft has been modified a second time if it succeeds in bringing the monoplane form into the standard equipment of the British service.

Sort of biplane's cosmopolitan?

As the general-purpose aircraft is supplied in greatest quantity to the R.A.F. than any other type, it will be considered in some detail. The types adopted by the R.A.F. is the Westland Whirlwind, a machine which can be used either as a landplane or a floatplane for bombing, reconnaissance, photogrphy or other duties. If the general of this type is accepted, with the exception of the biplane, the single-seater fighter, the biplane, and the Army co-operation machine, to give them their names, the Bristol Fighter, the D.H.5 and the R.E.8. The Whirlwind is a two-seat system of all-metal construction, with a large cargo space. The engine is the Bristol Jupiter while the replacement type of aeroplane brought out recently is a private venture by the Westland Company is fitted with the Pegasus engine of even higher (320) h.p. The Whirlwind has a top speed of 120 m.p.h. and a range of 200 miles. There are few more difficult problems before the designer than those presented by the general-purpose machine as it is visualised by the British Air Ministry. It must arrange not only for the normal two-seater requirements and mounting of the engine, but also for the needs of fields of fire, but also for such things as the prone bombing position for the observer, for radio

apparatus, oxygen apparatus, emergency equipment, spaces and stations and for the storage of extra petrol, and "decent" equipment.

A comparison between the performance figures for the Bristol Whirlwind and the Westland Whirlwind instructions. I quote the figures derived at the R.A.F. test station at Martlesham Heath.

British Bristol Whirlwind (1927)

	Weight loaded	Weight empty
Normal per lb.	1,170	650
Weight per kg.	530	290
Weight load added from fuel	—	—
Total loaded weight	2,000	—
Weight empty	600 lbs.	—
Weight loaded	1,400 lbs.	—
Length in ft.	32	—
Width in ft.	12	—
Height in ft.	10	—
Wing span in ft.	40	—
Wing area in sq. ft.	1,000	—
Wing loading in lbs. per sq. ft.	2.00	—
Wing aspect ratio	2.00	—
Wing load added from fuel	—	—
Total loaded weight	2,000 lbs.	—
Weight empty	600 lbs.	—
Weight loaded	1,400 lbs.	—
Length in ft.	32	—
Width in ft.	12	—
Height in ft.	10	—
Wing span in ft.	40	—
Wing area in sq. ft.	1,000	—
Wing loading in lbs. per sq. ft.	2.00	—
Wing aspect ratio	2.00	—
Wing load added from fuel	—	—
Total loaded weight	2,000 lbs.	—
Weight empty	600 lbs.	—
Weight loaded	1,400 lbs.	—
Length in ft.	32	—
Width in ft.	12	—
Height in ft.	10	—
Wing span in ft.	40	—
Wing area in sq. ft.	1,000	—
Wing loading in lbs. per sq. ft.	2.00	—
Wing aspect ratio	2.00	—
Wing load added from fuel	—	—
Total loaded weight	2,000 lbs.	—
Weight empty	600 lbs.	—
Weight loaded	1,400 lbs.	—
Length in ft.	32	—
Width in ft.	12	—
Height in ft.	10	—
Wing span in ft.	40	—
Wing area in sq. ft.	1,000	—
Wing loading in lbs. per sq. ft.	2.00	—
Wing aspect ratio	2.00	—
Wing load added from fuel	—	—
Total loaded weight	2,000 lbs.	—
Weight empty	600 lbs.	—
Weight loaded	1,400 lbs.	—
Length in ft.	32	—
Width in ft.	12	—
Height in ft.	10	—
Wing span in ft.	40	—
Wing area in sq. ft.	1,000	—
Wing loading in lbs. per sq. ft.	2.00	—
Wing aspect ratio	2.00	—
Wing load added from fuel	—	—
Total loaded weight	2,000 lbs.	—
Weight empty	600 lbs.	—
Weight loaded	1,400 lbs.	—
Length in ft.	32	—
Width in ft.	12	—
Height in ft.	10	—
Wing span in ft.	40	—
Wing area in sq. ft.	1,000	—
Wing loading in lbs. per sq. ft.	2.00	—
Wing aspect ratio	2.00	—
Wing load added from fuel	—	—
Total loaded weight	2,000 lbs.	—
Weight empty	600 lbs.	—
Weight loaded	1,400 lbs.	—
Length in ft.	32	—
Width in ft.	12	—
Height in ft.	10	—
Wing span in ft.	40	—
Wing area in sq. ft.	1,000	—
Wing loading in lbs. per sq. ft.	2.00	—
Wing aspect ratio	2.00	—
Wing load added from fuel	—	—
Total loaded weight	2,000 lbs.	—
Weight empty	600 lbs.	—
Weight loaded	1,400 lbs.	—
Length in ft.	32	—
Width in ft.	12	—
Height in ft.	10	—
Wing span in ft.	40	—
Wing area in sq. ft.	1,000	—
Wing loading in lbs. per sq. ft.	2.00	—
Wing aspect ratio	2.00	—
Wing load added from fuel	—	—
Total loaded weight	2,000 lbs.	—
Weight empty	600 lbs.	—
Weight loaded	1,400 lbs.	—
Length in ft.	32	—
Width in ft.	12	—
Height in ft.	10	—
Wing span in ft.	40	—
Wing area in sq. ft.	1,000	—
Wing loading in lbs. per sq. ft.	2.00	—
Wing aspect ratio	2.00	—
Wing load added from fuel	—	—
Total loaded weight	2,000 lbs.	—
Weight empty	600 lbs.	—
Weight loaded	1,400 lbs.	—
Length in ft.	32	—
Width in ft.	12	—
Height in ft.	10	—
Wing span in ft.	40	—
Wing area in sq. ft.	1,000	—
Wing loading in lbs. per sq. ft.	2.00	—
Wing aspect ratio	2.00	—
Wing load added from fuel	—	—
Total loaded weight	2,000 lbs.	—
Weight empty	600 lbs.	—
Weight loaded	1,400 lbs.	—
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Wing area in sq. ft.	1,000	—
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Total loaded weight	2,000 lbs.	—
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Height in ft.	10	—
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Wing loading in lbs. per sq. ft.	2.00	—
Wing aspect ratio	2.00	—
Wing load added from fuel	—	—
Total loaded weight	2,000 lbs.	—
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Wing area in sq. ft.	1,000	—
Wing loading in lbs. per sq. ft.	2.00	—
Wing aspect ratio	2.00	—
Wing load added from fuel	—	—
Total loaded weight	2,000 lbs.	—
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Length in ft.	32	—
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Height in ft.	10	—
Wing span in ft.	40	—
Wing area in sq. ft.	1,000	—
Wing loading in lbs. per sq. ft.	2.00	—
Wing aspect ratio	2.00	—
Wing load added from fuel	—	—
Total loaded weight	2,000 lbs.	—
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Length in ft.	32	—
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Height in ft.	10	—
Wing span in ft.	40	—
Wing area in sq. ft.	1,000	—
Wing loading in lbs. per sq. ft.	2.00	—
Wing aspect ratio	2.00	—
Wing load added from fuel	—	—
Total loaded weight	2,000 lbs.	—
Weight empty	600 lbs.	—
Weight loaded	1,400 lbs.	—
Length in ft.	32	—
Width in ft.	12	—
Height in ft.	10	—
Wing span in ft.	40	—
Wing area in sq. ft.	1,000	—
Wing loading in lbs. per sq. ft.	2.00	—
Wing aspect ratio	2.00	—
Wing load added from fuel	—	—
Total loaded weight	2,000 lbs.	—
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Length in ft.	32	—
Width in ft.	12	—
Height in ft.	10	—
Wing span in ft.	40	—
Wing area in sq. ft.	1,000	—
Wing loading in lbs. per sq. ft.	2.00	—
Wing aspect ratio	2.00	—
Wing load added from fuel	—	—
Total loaded weight	2,000 lbs.	—
Weight empty	600 lbs.	—
Weight loaded	1,400 lbs.	—
Length in ft.	32	—
Width in ft.	12	—
Height in ft.	10	—
Wing span in ft.	40	—
Wing area in sq. ft.	1,000	—
Wing loading in lbs. per sq. ft.	2.00	—
Wing aspect ratio	2.00	—
Wing load added from fuel	—	—
Total loaded weight	2,000 lbs.	—
Weight empty	600 lbs.	—
Weight loaded	1,400 lbs.	—
Length in ft.	32	—
Width in ft.	12	—
Height in ft.	10	—
Wing span in ft.	40	—
Wing area in sq. ft.	1,000	—
Wing loading in lbs. per sq. ft.	2.00	—
Wing aspect ratio	2.00	—
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Wing span in ft.	40	—
Wing area in sq. ft.	1,000	—
Wing loading in lbs. per sq. ft.	2.00	—
Wing aspect ratio	2.00	—
Wing load added from fuel	—	—
Total loaded weight	2,000 lbs.	—
Weight empty	600 lbs.	—
Weight loaded	1,400 lbs.	—
Length in ft.	32	—
Width in ft.	12	—
Height in ft.	10	—
Wing span in ft.	40	—
Wing area in sq. ft.	1,000	—
Wing loading in lbs. per sq. ft.	2.00	—
Wing aspect ratio	2.00	—
Wing load added from fuel	—	—
Total loaded weight	2,000 lbs.	—
Weight empty	600 lbs.	—
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Length in ft.	32	—
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Wing load added from fuel	—	—
Total loaded weight	2,000 lbs.	—
Weight empty	600 lbs.	—
Weight loaded	1,400 lbs.	—
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Height in ft.	10	—
Wing span in ft.	40	—
Wing area in sq. ft.	1,000	—
Wing loading in lbs. per sq. ft.	2.00	—
Wing aspect ratio	2.00	—
Wing load added from fuel	—	—
Total loaded weight	2,000 lbs.	—
Weight empty	600 lbs.	



W.A.C. University House at Princeton, New Jersey

Transport servicing for private flyers

Notes on Thompson Aeromarine Corporation's facilities for servicing Transoceanic Airlines' ships and those of private owners and other operators in the Great Lakes region. The eighth of a series of articles on transport maintenance.

B7

S. Paul Johnston
*Associate Editor of *Argonauts**

South Bend, Indianapolis and Bay City ATC cerebral work for Transamerica Airlines is carried out at the Cleveland or Detroit terminals, but all stations are entitled to give route planning services and to distribute certain standard arrival times. The chart is well indicated by the tables, which are reproduced here, with this chart is of primary interest to the private or managerial user, but it indicates also the status of the various stations, to serve the interests of passengers and shippers.

The Phantaz has held Department of Commerce Approved Status Certificate No 121 and is said to be the only airline in the country covering all makes of engines used on transport aircraft—Wright, Pratt & Whitney, Kinner and Curtis. A large number of passengers with stashed belongings often undergo space for the airplane, and bonus the offices and shops. The plane-to-one ratio is a one-to-one affair.

The first floor from front to back houses the operating officers, stenographers, engine shop and master-test house. The second floor houses officers, radio and instrument shop, and wing loft or fabric shop.

The executive personnel of Thompson Aerocarrier Corporation and its subsidiary, Transoceanian Airlines, is identical. Both are under the presidency of R. C. Marshall, John L. Roden, with headquarters at Detroit, functions as vice-president in charge of

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operations. The Tonawanda base is in charge of Benjamin F. Hawkins, and J. W. Norton heads up the activities at Cleveland. Personnel or regional managers are assigned to the several metropolitan fields where serving stations are located.

Transoceanic now to the operating subsidiary—Transoceanic Airlines Corporation it engaged in the transport of passengers' mail and air express in an area roughly triangular in shape extending from Chicago to Cleveland, and to Bay City, Mich., in the north.

Recently, additional schedules have been implemented, connecting Detroit with Buffalo. During the summer months (April 1 to Oct. 1) direct ferry service on amphibians is offered between Detroit and Cleveland, via Lake Erie.

All other schedules are conducted with head-eye machines. Besides the four Cycloidal-powered Lanning amphibians used on the Cleveland-Detroit run, the

The present capacity of the vision
which that demands from outside
as may be met with promptness and
skill.

Propellers have been designed to respond exactly with engine overloads.

The Ford, Fisher, and Loewengard is next to the shop for most every 1000 hours, the single-engine maintenance section, so that the engine is at 1,000 hours, and the main Michelson and Stevens engines are scheduled for overhaul at 1000 hours. Wright Whirlwind J-5s and Wright Cyclones are pulled for inspection at 300-hour intervals. The Pratt & Whitney R-1830s, the Pratt & Whitney Wasp, and the Lycoming engines are never run more than 200 hours.

Several stations have kept logs of their observations on all types of stagions in the flocks, and the average laboratory required for complete analysis of the carboxylates, oxalates, starches and rosins, are given in following table:

A number of interesting and useful gadgets have been developed, and are in use in the Thompson shop. Portable work benches, completely equipped with tools for various purposes, express

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SAC service sheet showing work which can be done at each station.

The service sheet showing work which can be done at each station.

on the stand, and the final installation on the ship occurs mainly by means of a complete assembly (except for cooling). In this phase, the insulation and lighting of a relatively few supporting bolts and the connecting up of the electrical leads are all that is required. For module assembly five hours have been set up at the Australian Airways ships in Dallas for Curtis P-40s and in the Pan American ships at Brisbane for Fords. There are still many difficulties to be overcome before a general solution is available, but it is not much to expect that in the near future complete airplane power plants can be built ready-to-install in the same fashion that certain motorcar engines are today. In some less sophisticated aircraft engine installation requires only the time, material and manpower and development of the sort anticipated above point toward the possibility of similar attainments in the aircraft field.

Transmissions. Engines start at forty percent efficiency, slightly less than that of the other lines. Generally speaking, batteries in transport aircrafts are removed and put on charge or the ground at once a day, regardless of the actual condition of the battery. Thus on those flights for which the weather is marginal, the better part of a day, the battery is put in fresh at the point of departure, and consumed at the terminal—a fresh battery being substituted before the airplane returns to its base. At several stations are usually equipped for battery charging, and the batteries are charged there. On the average, a battery may be one day in the air and one or two days on the ground undergoing charge or storage. The Ford and Wildard storage batteries in Transoceanus are handled on a schedule which varies somewhat, depending on whether or not the ships en

which the batteries are placed are equipped with generators. Those no-plans (Panamas and single-engine) which have no generator, have their batteries replaced and charged every day. Between is never more than a week, generally longer (Ford, Fokker, Sikorsky) to meet and Loosang) are inspected daily, but are

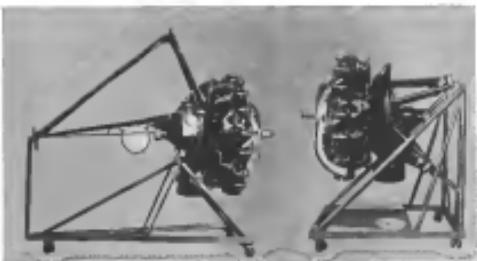
not removed for a bench charge unless the tests indicate the battery is in need of attention. The relative merits of the two methods of handling batteries can be determined only on a case basis. With the type of service to which these aircraft are subjected, Transoceanus requires that the average battery life is about six months.

Dope room fires

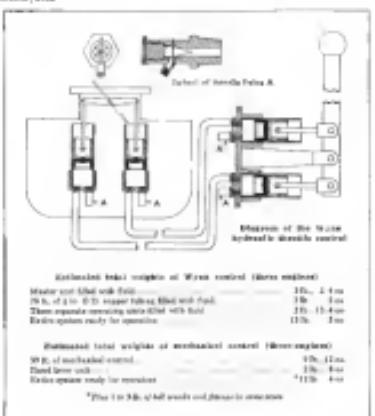
THE fire hazard involved in handling dope in airplane repair shops has long been recognized, but in spite of elaborate precautions, three occasions break out without warning in spite of the most careful handling. One was reported in the 1948 Naval Air Materiel Letter No. 382 dated Sept. 1, 1948, describing a fire which occurred on the dope room of the Naval Air Station at Norfolk, Va., on June 24 of that year.

The shop is of modern construction, steel frame, concrete floor, and insulated through two doors taking air through floor grilles so blowers outside the building. The air speed in the ducts is about 34 mph, and the blowers have enough capacity to give a good air change per minute in the room. In a second instance, a spark from a plate ventilation at a different end of the shop, but having separate power sources, caused a fire in the shop. Some faulty wiring was found in the shop, and a short dropped on the concrete floor or on the grilles. It was recommended specifically that all grilles be replaced with non-conductive materials, and equipped with starters to be fed from a separate power source. In a third instance, a short-sparking, liquid-fuel burner, that was leaking, was protruding within 50 feet of the shop, and no insulating materials were allowed in the shop.

Since faulty wiring can't easily be discovered by inspection, it is therefore necessary that all supporting members for shop parts be thoroughly grounded. Motors driving fans should be kept completely separate from the rest of the equipment, and should be of the squirrel cage type. Motor frames and all part-sparking components should also be electrically grounded. Dry sanding is a source of static electricity, and should never be attempted when shop fires are present. In addition, the obvious precautions should not be neglected. The minimum possible amount of dope should be used at any one time, and the rule prohibiting smoking should be rigidly enforced.



Left—Starboard main and bypass engine of Thompson Aerocraft ship assembly rank.
Right—Star engine for aircraft steering hydraulic motor.



Hydraulic throttle control

THE ordinary aircraft throttle control system usually involves a mixture of push-rods, bell-cranks, and linkages. For a three-engined installation, it is quite a problem to devise an efficient control system for the controls. This is due to the large number of joints and levers required. The linkage work is simplified, making it difficult to avoid sloppiness and the consequent lack of precision in throttle adjustments. Troubles from this source become apparent when precise synchronization of these engines is attempted.

Relieving this further improvement is possible. J. H. Wynn of Gary, Indiana has designed and has test-flown a radical new type of throttle arrangement which affords complete freedom from the缺点 of conventional engines. The engine drawing shows the operating principles of Mr. Wynn's scheme. The throttle lever in the cockpit is connected by suitable bellows to a pair of plungers operating in two small parallel cylinders. These cylinders are so arranged that as one plunger moves inward so an cylinder, the other moves outward. The butterfly valve at the carburetor is linked up through a valve to a corresponding pair of cylinders

Coupling taking account each carburetor cylinder with one of the throttle control cylinders. When each cylinder and valve is completely filled with a maximum-grade non-freezing fuel (No. 5 Diesel), the total hydraulic pressure exerted on the butterfly valve is sufficient to overcome the resistance of the butterfly valve itself. Each cylinder is fitted with a bleed valve if required.

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the needle type (A) to permit filling of each leg of the system completely without the use of valves. The pump and reservoir tank and pump are used to fill the system on the ground, but we can obviously carry on board the ship. Rubber expandable piping prevent leakage in the aluminum cylinders.

The new hydraulic elements of the system are completely enclosed in aluminum, and are under no pressure to cause leakage. If necessary, the system will still continue to function with one of the hydraulic connections completely broken. Sufficient valves can be arranged in the connecting cylinder, so that a measure of safety in case of damage can be obtained under an emergency condition of the system.

Calculations indicate that the Wynn system may be installed on an average three-engined airplane at a total weight of about 1000 lbs. as the estimated system weight is 100 lbs. For a four-engined installation the comparative weight of the Wynn and the lighter available mechanical control is not given in the calculation of the load.

The weights given above represent the system in its present stage of development. Further weight reductions and simplifications can be accomplished by certain improvements or design. For example, the weight schedule is based on adequately mounted operating units, whereas the ultimate construction will probably involve units built integral with the carburetor, resulting in some further savings.

Furthermore, the simplification of the Wynn system is independent of the shape of the interconnecting tubes, so that sharp bends can be made to get around obstacles in place of the large radius bends or the complicated system of fittings, valves and couplings required in older systems.

The Wynn hydraulic control has been flown for some hours in a single-engined engine, and arrangements are being made to apply it to a tri-engined installation for through test.

Welding hangar door

THE Electric Journal for October, 1952, reports an interesting welding job in the new Navy hangar being constructed at San Francisco, Cal., to accommodate dirigibles of the Akron-Massachusetts class. The door is 100 ft. wide and 100 ft. high, and is arranged so that the single plunger moves inward so an cylinder, the other moves outward. The butterfly valve at the carburetor is linked up through a valve to a corresponding pair of cylinders

side longitudinal, and were welded together in place during their welding cycle.

After the welding, the plates were ground down and were polished. A special check was made to see if each joint was closed to detect where the plates separated. Over 30,000 sq. ft. of floor was paved in this manner, the job requiring about 40,000 sq. ft. of electric arc welding.

EDITORIALS

AVIATION

EDWARD F. BEAUMER, EDITOR

**Selling air transport
is everybody's job**

THE readers of *Aviation*, without exception, have a deep personal interest in the prosperity of the aeronautical industry, from which a very large proportion of them actually drew their livelihood. Fortunately, their interests need not be a quiescent one. You need not wait for prosperity to be landed in you like a silver platter. You can go out and create it for yourself.

Air transport is the new backbone of the industry. It is air transport that is stiffening the whole structure. If we want to promote the success of aerial factors, or of any kind of aerial operation, the most important thing that we can do is to work for an increasingly rapid public acceptance of travel by air, and start every one of us can take a hand.

We may not all have the opportunity of giving sales talk on air travel. Some of us may be stuck in the gift of salesmanship that we would be of little service in that connection in any case, but whether or not we can take a positive part in the development of traffic, we can at least refrain from taking a negative one.

Air transport has closed its first bundle. Its existence is generally recognized. Almost everybody now knows that it is possible to travel from one city to another more quickly by air than in any other way, and at a cost not much exceeding that of the railroad journey. What happens to keep people out of the air is not so much ignorance of the service that is being rendered as fear, suspicion, uncertainty, and inertia. These factors will pass if their own account if they are given nothing to feed upon. It is the proper job of the people actively interested in air transportation that goes not only for those in the employ

of the transport companies, but for draftsmen, airport managers, police, pilots, and a whole lot of others—to set the wrinkles and its ugly blemishes are digressed of measurement.

OBVIOUSLY, nothing will create sympathy so effectively as a ledger that aeronautical operations are beyond improvements by overenthusiastic experimenters. There was a time when there was some reason for such a feeling in connection with early air transport operations, but it has long since passed. If you want to know how completely it has passed, turn to *AVIATION* of three years ago, and read an article by P. W. Head, entitled "Air Transport From the Passenger's Point of View." It was a tale of hair-raising adventures resulting from haphazard methods. At the time when it was published it was a fair and conservative story of what will occasionally occur by the means of air transport. Only three years have passed, and already it reads like a tale from another world, so utterly remote is it from present-day experience.

So far the work has been well done, but the paternal instincts of air transports do not always discriminate. They do not realize the difference between transport personnel on duty and transport personnel enjoying their leisure. They do not even distinguish between air transport companies and a thousand miscellaneous operators. The public judges the aviation business and the people in it as a whole, and the public's point of view toward air transport over the next two or three years is going to depend very largely upon what kind of people seem to be in the aviation business, and how they seem to behave.

THIS writer of this editorial once owned a motor cycle. He bought it from a local dealer who was a jovial person with a host of friends, generally acclaimed to be "a great guy and a swell salesman."

About a week after the machine had been sold, and while it was still being garaged in the dealer's shop the great guy assured himself one evening by interchanging the ignition wires on the magneto so that each cylinder fired at the end of the exhaust instead of the compression stroke. Then he stood around making gleefully idiotic suggestions while the proud but somewhat ignorant new owner struggled in vain to get the machine started. It was a good joke, and the victim was able to laugh along with the spectators, though somewhat half-heartrily, when it was explained to him. It was a good joke, and that particular dealer soon went out of business. There were a lot of people just like him in the motorcycle business, which is one reason why it has gone so extensively on the rocks. This one is worth bearing in mind as a memorable example. A few wild souls, or a small number of sentimental people with eccentric habits and unashamed stains of humor, can do more harm to air transport than the most skilled airline operator in a year. If a solar eclipse gets off into his head that airplane pilots are blind to all practical jokers or irresponsible visitors of adult inclination, it is going to be a difficult matter to convert him to air transportation.

THREE or some 18,000 airplane pilots in the United States, and they are all kinds. Most of them are self-respecting gentlemen with a sense of having entered upon a dignified profession, some of them are not. Every one of them has the propensity of air transport in his keeping in some measure. Every one of them is born that is wise, and is to be reminded of it as often as necessary. If the pilots who are out of work now need to get jobs, or if those who already have jobs want to put better ones, it is very much in their interest to help air transport grow. They can do it by maintaining a personal appearance and a standard of behavior, both in the air and on the ground, which will command the respect of those with whom they come in contact, for if the caption of industry who ought to be traveling by air feels respect for the unremunerated people that he uses, he cannot help respecting the reputation of the aviation business staff.

Flying boats**French Frigates**

ALMOST unheralded and unsung, a Navy patrol squadron attached to the Pearl Harbor Air Station has recently staged a flight that may open a new era in American high-speed aviation. Six flying boats have cruised in formation from Pearl Harbor, a few miles west of Honolulu, to French Frigates

Shoals. They headed at French Frigates, stayed over night, and took off again the next day and came back home. The distance was only 300 miles. The speed was only 85 mph. Compared with the exploits of French Hawks, Doves, or Pintos and Gouty it sounds an uninspiring performance, but it was the symbol of a new idea.

Take the largest atlas that you can find, open it to the map of the Pacific, and look for French Frigates Shoals. It may not be there. Little more than a coral reef rearing in a boundless ocean, it was beneath the notice of many of the map-makers. The charts show it only as a spot upon which a ship might run aground. Yet it has become an aeronautical landmark.

American political and naval interests lie largely in the Pacific. Flying boats will never have attained their monopoly in the Naval service until they are able to operate freely over the Pacific. Up to the present time all of our flying-boat operations have been essentially coastal in nature. The patrol squadrons have worked up to Key West and Guantanamo and Coco Solo to cover the Caribbean. They have operated along the Pacific Coast of the United States and Central America and within the main group of the Hawaiian Islands but they have never yet really struck out across the sea under service conditions. The NC boats made a beginning in 1919 with a transoceanic flight, but it was never followed up. There was another trial in 1925, when the PBF's set out from San Francisco for Hawaii, but that was a sport and not a really valuable one. In the meantime, the flying boat squadrons of the R.A.F. have been probing the comparatively sheltered seas of the Eastern Hemisphere, and even reaching out into the Pacific as far as Australia and the Philippines. Von Gotha has repeatedly crossed the North Atlantic, and finally completed a lengthy jaunt by flying boat around the world. Most specimens of all of the Italian Air Force, after years of preparatory cruises on a more moderate scale, have flown a squadron of boats from Chile to Brazil by way of West Africa. The last has long been ripe for the American Navy to undertake similar flying-boat cruises of its own, by squadrons or even larger groups.

THIS flight to French Frigates, small in itself, is a beginning. Beyond French Frigates lies Midway, and then Wake, and then Guam, and then the Philippines, all of them under the American flag and with no hop of over 1,000 miles to separate them. To the south of the Philippines is Australia, and then to the east, at distances of 1,500 miles or less, come the new Hebrides, the Fiji group, and getting back to America, the Samoa, Palau, and once again Hawaii. The Southeastern Pacific could be circumnavigated in 18,000 miles. The patrol squadrons would have gained a new experience, given their equipment a new test, demonstrated an ability which we fully believe that they possess to operate over distances hitherto

undulated or and last log by so many less, a new directory would have been formulated for transoceanic air commerce.

We believe that the organization of regular flying boat service on half a dozen routes like that between Jamaica and the Canal Zone, upon which Pan American has been keeping its Comodoro's busy, but longer and more difficult, is a matter of the very near future. The pioneering work goes slowly because of the enormous cost of developing the equipment, proving it out and negotiating the routes. Nothing could be more helpful in streamlining American air transport over the open seas if we were helpful to the American industry, in finding foreign outlets for Venezuelan flying boats, than a really spectacular squadron built by the Army. With the interest of naval aviation of the manufacturing industry, and of air transport operators all in mind, it ought to take only a very little time to get into action.

We hold as brief for the speed inventory that we have suggested. There may be better plans than a Clock Two of the Southwest Pacific. A round robin flight from California to Hawaii might be better, but our advice should be selected and more flight miles which will be as dramatic as ever and as spacious a proof of the qualities of material and men as was the America Fleet's cruise around the world 24 years ago.

New activities, new income

WHEN a man finds that the amount of business that can be done in his line is shrinking, he has only three alternatives. He can, up to a certain point, stick the knife into expense in an effort to keep the margin of profit the same as before. He can escape himself to the current state of affairs, and to accept a smaller income than is past. Or he can go out looking for some new kind of business to supplement the old, and to build his gross turnover back to its former dimensions.

The first possibility is logical. Most men accept the second, and their own standard of living goes down with the volume of their sales. A few, however, take the third course, and during the present depression a lot less name popular than ever before.

New stores are selling orange juice, and soda fountains are making sodas for refreshments. Drug stores are selling sporting goods. Shanty stores are selling groceries, and grocery stores are selling tires and lubricating oil. Retail merchandising has become a gaily ring-around-the-ring which ends up with plenty of

entertainment and confusion, but with no real profit for anyone. There are a few cases, however, in which the knowledge of activity is not only permissible but exceedingly wise, and the operation of airplanes is among them.

A FEW years ago there were airplane dealers who did nothing but sell airplanes, or at least try to. There were repair shops that handled only maintenance work. There were operators who did nothing but photography, and there were others who did nothing but cross-country charter service and who scorned flying. There were specialists in drafting, and specialists in advertising. Some of them are still specializing, and a few of them are making a really good living, but they are in the minority.

Under present conditions it is an extraordinary case in which a single type of flying will bring enough gross income to return the net profit to the owner which a man of the capacity required to operate a flying service is entitled to expect. There are several hundred small airports in the United States, each with one or two operators. In not one case out of ten have the small-town flying services really explored the limits of their own possibilities. They offer to do one or two special types of work. If they are asked to take on anything that they are usually willing to try it, but it is their job to go out and sell the service themselves, instead of waiting for a customer to come in and tell them exactly what he wants and insist on their getting it at home.

There is hardly a city in the United States of 30,000 population or more where aerial advertising couldn't be used to occasional advantage. There certainly isn't a single community that doesn't hold out prospects for photography, and while there are a great many pilots who are qualified in the photographic art, every village has its local professional or enthusiastic amateur amateur, quite ready to go into partnership with the airplane owner and to supply the cameras and do the photographic work.

We might as fast, set up a page in listing the things that are waiting to be done elsewhere than see airplanes, but it would be a waste of space, for we are doing just such a list every month in the department called "Airplanes At Work." Take up the last full-dated issue of *Airplane* and read over that department, and let your imagination work upon the uses for airplanes that you find listed there. If you will make a real effort to apply them to your own case, or to develop them into others that can be applied to your own case, and if you have learned use of those operations who have resigned himself to having no income except a little percentage carrying at performance, we shall be very much interested if you do not succeed in doubling your gross revenue and considerably more than doubling your net profits.

NEWS OF THE MONTH

6-card flight division merger

ACILIA WAR is raging within Aviation Corporation. Dissidents were split by R. L. Cord, largest stockholder, when the management made a proposal to split the assets of North America Aviation Inc., and, eventually, of Trans American Aircraft. They proposed to issue about 19,000,000 shares of Aviation Corporation plus a cashing-in for prop aircraft, and to issue 10,000,000 shares of Trans American. They planned to split the Canadian unit, Sperry Gyroplane, R/V Aircraft, and the British subsidiary, Air Transport. Mr. Douglas Alcock, a rather nervous transatlantic pilot, was a strong advocate of the split. Mr. Cord had made almost daily a year before. This included a four-hour private trip to Washington to talk about 100 gal. of gasoline, and a brief meeting at the bus terminal in Princeton, N. J., along with Mr. Alcock, Mr. Clegg, and Mr. George Christie, Pres., as well as to Washington. Cord brought with him a Westinghouse supercharged in about 350 hp. Windshield, a chrome and black racing rim of his own design, a combination seat and safety belt, and a leather jacket. On Monday he averaged 260 mph in the alleged three-plane contest.

During the heat of the debate, he opposed on the grounds that it set to the best interests of either company. Mr. Cord seemed a temperate negotiator, but retaining the directors of the corporation concerned from acting as the transactional committee of the corporation, he recommended that a stockholders' committee be called for Dec. 25 to exercise the difference from 25 to 25 (losses which another had been reduced) plus 1/2 giving the Cord and other minority in assets an opportunity to sell off 34 3/4 shares through which the right might be taken to buy out the remaining 1/2. Clegg and Christie both came in on setting the price of the 20,000 stockholders' votes.

Last word from the front line is that upon petition by Aviation Corporation the stockholders' committee has dissolved the corporation continuing the interests of the company from dissolving the deal with their stockholders upon condition that the directors, meeting, submitted for Nov. 13 and from which date the stockholders' committee has been powerless to act, give Mr. Cord of another decision day on the West Coast the opportunity of being present when the stockholders' committee.

Both petitions and protests sought in public appeal to stockholders (given largely in *Aviation*'s letter to *National*) to support the stockholders' committee to the extent of a majority of the stockholders' votes to be cast in the event of a stockholders' vote to dissolve the corporation.

Thirty planes, largely propellers, owned, were on the program ridge of Island Matapedia Airport at St. Georges a few days earlier. More than 300,000 passengers were carried on 100 of the 120 flights. The 11th flight, L. J. on Oct. 30 to witness a progress of starting military exercises, hand-dropping and speed contests, Cycle Pionnier, Clermont Chaudron,

Air Transport, in 1930 when the New York Chicago run was started, to the 1932 flight with a 700-hp. Gipsy Major 14 K engine, a speed record of the sort which was made in September by M. Lamotte, averaged 372 mph between the Dakar and Rio de Janeiro capitals.

Mr. Lamotte, in his 1000-mile race across France for the Deutsch cup, won a Post Modis monoplane built by the French aviator, M. Moreyret. Accompanied by nine passengers, he flew the circular route from Dakar, over Paris, to 10 hours

to Algiers, and back to Dakar.

From Dakar, M. Moreyret, who

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route from Dakar, over Paris, to 10 hours

to Algiers, and back to Dakar.

Mr. Moreyret's victory, fourth in succession

to go to a British aviator, was

made by the only British aviator to

win the Deauville 2000-mile race, the

shortest and steepest straight flight in

1930 and '31 to Dakar.

French and British crews

were represented and Post Modis

of the first contestants in the

Argentine Trophy Race starting and

ending at Buenos Aires won their

titles in 1930 and '31 with

Post Modis engines, the only French

aircraft entered of the Mysore StarFlight

Trophy and the prize of about \$40,000.

Thus in the last seven years international

aviation and the territory of South America

have been opened to the British

and Argentinean.

The winner's base was slightly under these

days, coming up nearly a day longer, while the other entrants did not finish the race.

Local air meetings

Air shows and demonstrations have held the attentional stage in this country. During a Tuesday air pageant at the Rhode Island State Airport, James Weller made a new attempt on the world's record for altitude, which he had broken at 300 mph in his last air race, the three-linerer contest, but failed to reach the 10,000 ft. mark. The British pilot exceeded a height of about 15,700 ft. The previous record, which the British pilot exceeded by about 2000 ft. had been set in April, 1930, by S. H. Parker, 1900 kg., and Mr. Parker's Fairey 220, powered with a Gipsy Major 14 K engine, averaged 200 mph against 1900 mph.

Having records for which we aspired the British cap, we also went established recently by French plane, a Darracq 1300-hp, single-seat, powered with a 2500-hp Hispano-Suiza engine, which was the first to win the three-linerer contest. The French Air Ministry flies from Paris to Biarritz at an average speed of 240 miles an hour. The British biplane cap, awarded for the best speed between Biarritz and Biarrest, was won



TINA FOUR-SEASONS BIRDS OF SINGAPORE

A departure from the conventional

BY FAR the majority of the australidines discussed in these volumes during the last twelve months have had at least one characteristic in common—they have lacked antecostal notching. In previous years there have been very few, if any, examples of australidines with such a feature, and it has usually been regarded as a radical innovation that has been reluctantly avoided. A new step has been introduced this year, however, which, although containing many conventional features, shows definite originality in its lack of antecostal notching. This is *Cervulus wrighti* from the Cretaceous of Kansas, as described by Wright, Koenigswarter, and Wright (1967). The first of a new series of *Stereomorph* embodying unusual characteristics.

Magnus singer has occasionally pursued an ornithological studies to improve the validity of his theory above. In 1937 he did not set the Balsam-egret negative setting of the tail wing of the heronry as it started departure to American continental process. The reason for his adoption is essentially the same—better pilot visibility forward, coupled with certain anatomical advantages, particularly the location of the front pair of the feathers with relation to the feelings and landing gear. The single set of flying wings is attached to the upper from nose at the sides, at the wings and pens through the lower wing to the landing gear, thus forming a very dry and rigid training system.

Aerodynamically, negative stagger has been viewed with some suspicion in the past on account of a tendency of the lower wing to "blister" the top wing at high angles of attack, conditions resulting

ing or unsatisfactory cutting and spending tendencies. Wind tunnel tests on the new model, with its naturally high degree of negative camber, have shown that the cambered airfoil has a much steeper angle of attack at the leading edge than the flat cambered airfoil. It is claimed that the cambered airfoil will produce a more rapid development of lift as an improvement in air flow over the wing tip at angles of attack up to 15°.

in a glide. The last named device is generated by the propeller of a Potez-Mot, and is the Dutchman. On the former, the parasitic drag is built upon a glide by turning two propellers which create headwinds in the wind (AVIATION, September, 1931, page 305). The same effect is obtained on the Dutchman by using two sets of blades. For instance, the two sections of the nacelle are linked together, and function in the normal manner. To



The business end of the "Masons" Stage circus was within Cripple Creek and a new affiliate record set during it.

Infl. excessive gliding speed, however, the two halves may be moving apart, and thus act as opposing valves. During the early stages of the leading sail, the aerodynamic effect of the "depressions" is of assistance to the unchanged leading sail because the air moves in a curve.

The flying gear is completely enclosed in a housing which is bolted directly onto the lower wing and contains the engine driving a pair of propellers. The tail section is non-enclosed and is almost completely enclosed in the under part of the fuselage. The construction, rather for simplification of design and three weight and maintenance expense has been kept to a minimum by the greatest practicability of the methods. Advantage has been taken of the space afforded by the film as the utilization of wire, gauze and sheet metal.

The bearing is completely surrounded, and is subjected to a pressure which holds the roller. All bearings at the wing roots, undercarriage and fairings are integral parts of the covering. The condenser of the cockpit forward is worthy of note, as it comes off the fuselage lines to a second degree.

All aircraft are mounted on lower wings only. They are of high aspect ratio, and are rigged for differential operation, -15 deg. up and 15 deg. down, a feature which improves control at the stall. Wing leading edge slats are of steel, while

AVIATION
December, 1911

are spaced 5 m apart. All surfaces are false covered. A single stream lined, heat-treated sand of the racing type occupies upper and lower parts in each bay. The wire and cable fittings are enclosed in the wings.

All flying controls are fixed or ball bearing which are sealed against dust and which require no lubrication or attention. Considerable study has been made of the aerodynamics of all parts for maximum strength, weight saving, for example, is put on in hinged sections which may be readily lifted or removed. The main action is fixed to the engine, and only the rear panels need to be lifted.

The engine fitted on the present Model 17B is a Wright "Hercules" R-975-2 air-cooled, six-cylinder, pusher-puller. The ship has been built around the new Wright two-row, 600-hp radial. Engine driven fuel pumps are mounted, although a hand pump is available for emergency operation. Many accessories are included as standard equipment. Radio sets are installed and are separately sponsored. Parachutes are stowed under the fuselage. Color lighting and ventilation are provided for, and ample baggage space is available.

The general characteristics as furnished by the manufacturer are: Span, 34 ft. 4 in.; length, 24 ft. 3 in.; height, 8 ft. 7 in.; wing area, 160 square feet; aspect ratio (mean camber), 3.00 at p. t.; weight empty, 2,208 lb.; useful load, 1,880 lb.; gross weight, 4,088 lb.; wing loading, 16 lb. per sq. ft.; power loading, 10.7 lb. per hp.

which at a tip speed of 3,000 rpm at which speed the total compression ratio in the blower is 18.5. Although normally the threads should never be fully opened at ground-level, calculations have indicated that with the supercharging the engine attitude develops 100 kg. of over-load. Calculations indicate that if the altitude reached by aircraft Union, the actual output was 170 horse-hundredths. These are even easier way to increase the compression ratio to 8.1 in the hopes of raising the ceiling another 2,000 ft. with the same engine and for some extra

Heinkel He64

carried along the top of the fuselage to the fin. The structure itself is monocoque, consisting of wooden ribs and longerons, covered with plywood. Seats are provided in a cantilevered arrangement at strategic points to prevent rotation of the interior. The radio-controlled steel tube engine mount is fixed to the first bulkhead, which is fireproof. The main oil tank is located immediately behind the fire wall, and a secondary tank is fitted to the mounting between the front and rear endoplane bays; these are adjustable and dual controlled.

The songbird is represented in shape, as it is in color, by a combination of rounded, and in addition, the slender, strongly-arched tail. Following Beaglesque practice in general, the requirements of the robust house-competition are, in particular, the wings held high, the legs tucked under, and the tail starting upwards. A simple lever-based tail posture permits the recognition of whether the bird is flying or not. At 30 seconds, panels are left completely blank, and the songbird's song ends, and are provided to intercommunicate automatically that and taking steps. This is said to be on the basis of application of skins and feathers on a baseline with a single under-wing. The bird-singing is a single under-construction, the main song—therefore covering the entire body, the head, the neck, the wings and spurs.

The Henschel Hs 123 was an all-metal, single-engine, longitudinal-surface monoplane fighter aircraft built by the Henschel Flugzeugwerke in the early 1930s. The aircraft had a shoulder-wing configuration, the wings being supported by two slender, thin-walled, tapered spars. The main landing gear was a fixed, tail-dragger type, while the tailwheel was a retractable type. The engine was a liquid-cooled, inverted, inline, six-cylinder, air-cooled engine, driving a three-bladed propeller. The aircraft had a single-seat cockpit, enclosed by a large, curved, bullet-proof glass canopy. The fuselage was a light, all-metal construction, with a large, rectangular, front-mounted engine cowling. The aircraft had a single-seat cockpit, enclosed by a large, curved, bullet-proof glass canopy. The fuselage was a light, all-metal construction, with a large, rectangular, front-mounted engine cowling.

A black and white photograph showing a small aircraft, likely a glider or a biplane, lying on its side in a field. The aircraft has a single seat and a single propeller at the front. It appears to be damaged or has crashed.

此題為中文題，請用中文回答。



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THE INTERNAL COMBUSTION ENGINE, by D. R. Pye, Oxford University Press, 1952, Cloth \$19.50, 250 pages.
This book is a most valuable addition to the field of internal combustion and thermodynamics as applied to the internal combustion engine, and to the results of the latest research in this field, the book covers the ground well, and is a valuable addition to the library for the competent user of Mr. Pye's extended and eminent work in this field. It is, happily, no either-or work, but constitutes a valuable addition to all the other important aspects of the modern combustion engine, and is written especially for the trained engineer, or for the advanced student of the subject. I can heartily recommend it to all those who have been able to see its usefulness in their own work.

THE BEAUTY OF FAIRIES, by Margaret Cowley, John Day Company, New York, 1932, 100 pages; \$5. Unquestionably the most beautiful collection of serial photographs, and especially photographic close-ups that has ever been published. A perfect art gallery bound between covers. The pictures come from many countries, including some taken from the U.S. Navy and a like source from French Survey, and have been selected and arranged by Dr. Margaret Cowley, famous authority on the mythology of faeries.

SENILE ALZHEIMER'S AND AGE Alzheimer, by Col. C. C. Carter; *Reddit Press, New York, 1927.* 114 pages, \$1.50. The latest development of this well-known disease, first prepared by McCord Field seven years ago. This latest edition is a post general national on design practice. There it is still much more advanced in treatment of some sections than others. An ideal text for a general course in aerodynamics would contain more material on design practices and structures and less on servodynamic relaxations. A good list of questions, for examination or review, is intended to each chapter.

Wives Over Poland, by Kenneth M. Murray. D. Appleton & Company, New York, 1926. 36 pages. \$1. The story of the Kaczynski quadruplets, 1926-27. The events described were interesting and exciting, and little has hitherto been known concerning them.

but the style of the book is irritatingly melodic.

Nicaragua, by Agents of St-Eustache. Gregory Company, New York, 1882. 196 pages, \$1.75. A short work in which account is taken

WHAT OUR READERS SAY

To the Editor:

I have read with much interest the abstract of an article by Loren L. C. Ramsey. In general, I agree with Lieutenant Ramsey's conclusions, but I dissent from his viewpoint that a broad is potentially more destructive than a torpedo.

There are two great difficulties about bombing. The first is the difficulty of hitting your mark. There are six major sources of error:

3. The difficulty of maintaining the longitudinal axis of your plane exactly level.

2. The difficulty of maintaining the transmission axis at your plane exactly level.
3. It is impossible accurately to control the swing.
4. You will be compelled to know

5. Summary. It is necessary to know the speed of the air relative to the sea.

All six of these elements of error are wiped out in the case of torpedo-carrying aircraft.

Second, comes the danger to the *Spiders*, which makes 10,000 ft. a minimum distance of reasonable safety up which to fly when the weather is clear, and, of course, if the weather is not clear, it impedes the vision, both of the *Spider* and the attacked. In order to have a reasonably good chance of hitting a wasp from a height of 10,000 ft., it is needless to say, that the *plane*

significance importance as compared with the struggle with the elements. "Night Flight" has been acclaimed as a masterpiece by the literary critics of South America. Aeronautical engineers have said it is the best account of year of their lives for the sake of a hard-headed operational manager and his men and how he managed them, and of the episodes of one flight through a South American storm, made up in a story by one of the most experienced of South American airmen.

use a practically impossible task for any anti-aircraft gun. The torpedo-carrying seaplane, on the other hand, can approach on a curve, change direction, its speed, its altitude every second and making the most difficult possible mark for an anti-aircraft gun to hit. It is very easy indeed to lay down a search-area around a battleship or a fleet, with machines flying in zigzag courses, at varying speeds and various altitudes thus reducing to a negligible point the chance of hitting by gun.

With the techniques now available, the distance that they will proceed under their own power is great enough to reach the most distant vessel in a fleet from a point to which an intercepting naval aviator would dare to approach without more danger than it is usual to face.

If the first air-processor is unfortunate and the torpedo-carrying airplane starts back behind a smoke-screen, there is about one chance in three of hitting something. Under any conditions, the chance of getting a hit is far greater than one chance in three.

Now, there are certain conditions under which the bomber is better than the torpedo-carrying airplane. In the first place, when a torpedo-carrying plane descends to deliver its blow, it subjects itself to the attack of pursuit planes and an adequate force of pursuit planes would keep torpedo-carrying machines at a safe distance and make it much more dangerous for them than for bombers which might be able to deliver an effective attack before the pursuit plane could get above them or near enough to be dangerous.

Governor L. Cason
Governor-at-Large
National Arsonistic Association

TRANSPORT

Operations and Traffic Management

Promoting South American air travel with figures

their actual selling energy available. An express train set also quoted for the transport of samples and other heavy material required by salesmen.

New transport instrument board

AS A RESULT of a long and intensive study under the general supervision of Dr. Howard Stark, Research and Testing, Inc., we have recently developed a standard instrument which will indicate the presence or absence of the minimum velocity required for flight when outside visibility is limited. The instrument has been made entirely independent of the eye movements and their associated errors. It is a device which can be used in conjunction with the eye for minimum flying, with the regard of the field of the pilot, so that a check to minimum flying does not require any great physical or mental adjustments. In addition to the benefits resulting to the pilot from the use of this instrument, it has been successfully applied to MI operations on the basis of the

Water Bonds	Days	Expenses
New York - Worcester, steam ship trip.	8	\$102.00
Indicated collections bonds	1	1.00
Other expenses	3	2.00
Railroad fare and automobile travel Worcester and Coll. C.	1	6.00
Coll. C. fare	2	4.00
Railroad fares, hotel meals and room rentals Worcester, Boston, Coll. C., Montgomery, Albany, New York	10	36.00
Meals and hotel	10	18.00
Engagement deposit	1	10.00
Balance for twelve days at \$400 per day, plus \$100 for expenses	12	520.00
Less in advance \$120.00		390.00
Total	12	\$488.00
Gas Bonds	Days	Expenses
New York - Miami railroad fare, round trip	4	461.00
Round trip boat fare	3	30.00
Round trip Miami - Paracapula	10	120.00
Gasoline, food, hotel, railroad fare, telephone, laundry, etc.	14	140.00
Gasoline, laundry, etc.	1	10.00
Balance for 12 days - \$400.00	12	480.00
Less in advance \$120.00		360.00

Beyond the actual cost savings pointed out in these tables, attention is called to the advantages of air travel as a means of reducing standing damage. It is argued that passengers arrive at their destination with 100 per cent of



These investigating teachers must parallel the K-12 U.S. teacher mission.

TECHNICAL ABSTRACTS

More data
on nacelle drag

DEAS TECH 4/3 SCALE Model. Effects Nacelles with Variable Convexity. By Ray D'Addio, Technical Note No. 442, National Advisory Committee for Aeronautics.

IN THIS COURSE of the numerous runs of interference effects between nacelles and wings now under way at Langley Field, a detailed study was made of nacelle form apart from the wings to determine optimum shape and the effect of various types of flow control, such as variable leading edge slats, and the effect of propeller offset. All results were obtained without propellers.

Two general nacelle forms were tested, the first (B) was the standard conventional nacelle. The second (J) was the same, except that it was provided with a series of four angle sections along the chord and one of the end walls was inclined at an angle to the axis.

The results applied to the two forms of test were of three general types: first, the full NACA nacelle, second, a series of three fixed angle sections, and third, the variable angle sections.

The fixed-angle sections were relatively wide and thin, and the angles between the nacelle chord and the three lines of the nacelle were 0.0 deg., -10 deg. and -20 deg. respectively. The variable-angle sections were set up in a manner so that a wide-angle nacelle, the chord angle of each side could be adjusted from zero degrees to -15 deg. with respect to the thrust line. The fixed-angle nacelles were tested at three different positions here and all with respect to the plane of the wing. The results showed that the variable-angle nacelle tested in two line and at an position (D, 0)

It is impossible to give in a brief space the detailed discussions and the full results of these tests, but the accompanying chart shows the results of the recent tests of the nacelle tested at the full-line nacelle at 100 miles an hour, will give some idea of the general trend.

It is shown that the popular belief that almost any kind of a wing can be used with a nacelle is not quite correct. Several combinations of wing and engine gave drag which are considerably higher than that of the bare nacelle. Although the free-stream baseline of the wings after the drag, the angle of the drag said to the thrust line is a measure of the drag. Thus the full NACA nacelle in an optimum location, gave better results than any combination of fixed or variable nacelle.

ring in any location fore and aft. Even the bare NACA nacelle without lead gives lower drag values than most of the variable and complex NACA nacelle, and the complex NACA nacelle with lead in position, yielded a drag figure below that of the smooth streamlined body tested.

These were made on all combinations of wing and nacelle, except the propeller. There were seven full NACA nacelle runs per test result. In general those configurations which had the lowest drag at zero degrees of pitch, had the lowest drag throughout the entire pitch range, but the lesser the type of the propeller, the greater the variation in drag with angle of pitch. The magnitude of the variation of average of drag on the angle of pitch is indicated. These results cannot be considered as conclusive, for the effect of the propeller must be taken into account. It has been found that the nacelle which gives the best results with the propeller in the front, however the best combination with a propeller is not known. That report, however, is considered as preliminary, and further work will have to be done with complete nacelle and propeller simulation.

On the problem
of engine cooling

HOT AIR EXHAUST FROM A FANLESS CYLINDER AT DIFFERENT FWD-PAC AIR-STEAM ANGLES. By Owen W. Tolley and Arnold E. Sherman, Technical Note No. 478, National Advisory Committee for Aeronautics.

AS the problem of engine temperature is turned to extremely complicated with the introduction of the fanless cylinder, investigations have been conducted at the Langley Laboratory on the relationship between the direction of air-flow over engine cylinders and the rate of heat dissipation. A series of a number of tests was made with a fixed nacelle, with variable electrical heating and temperature measuring apparatus, and mounted in a wind tunnel in such a manner that the angle between the air-stream and the cooling fluid could be varied between 0° and -20°. Tests were conducted over 25 deg. of total head winds, ranging from 10 to 240 ft./sec. per square inch of nacelle surface per hour, at a constant air speed of 16 ft./sec. Tests were also conducted over the same regular range at a constant head speed of 10 ft./sec. per square inch of nacelle surface, at a constant air speed ranging from 20 to 150 mph.

Temperature readings on all parts of the cylinder indicated that the rate of heat dissipation is greatest when the cooling air is directed at an angle of 45 deg. to the air stream, and least when it is parallel with respect to the air stream. The rate of heat dissipation is dependent upon the difference between the cylinder and the air stream as reflected from 30 to 30 per cent with the flow at 45 deg., an increase with air-flow parallel to the cylinder. The amount of the reduction depends on the air velocity and the point selected for measurement. At a constant cylinder temperature, the total heat loss to the cylinder can be increased 50 per cent with an air stream angle of 45 deg., as compared with a parallel flow.

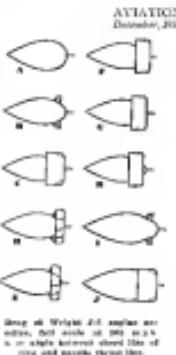


Diagram showing six aircraft nacelle configurations labeled A through F, illustrating various angles and shapes tested.

AVIATION
December, 1952

AIRCRAFT AT WORK

Air express and
the movies

MODERN industry makes use of air express in the handling of moving picture news rolls by air express. The public appeal of the news roll depends to a great degree upon the speed at which it is delivered. This is a rapidly growing field of pictures that are sent with their running comments by way of one of the well-known local studios of the screen, for they cannot be distributed until the appropriate sound recordings have been made and recorded on the news roll.

In the United States, an average weekly

tonnage of 4000 tons is carried by air express. The number of news rolls required to accommodate these requirements is an \$1,000,000.00 per day sum estimate in connection with the Hoover Line. The necessary negotiations for material and labor which, in the ordinary course of events, would take several months, were completed in less than a year and a half and put into operation.

A series of pictures of the recent Chinese-Japanese conflict was shipped by steamship from Japan in order to make mandatory express arrangements for the use of the news rolls. The pictures were to be taken in the early part of December and were to be completed in five months. During that time the two men handled over 100,000 miles by air to visit practically every corner of the United States.

By ANTHONY L. COOPER

The American Council of Defense was asked to summarize its findings on the negotiations on an \$1,000,000.00 per day sum estimate in connection with the Hoover Line. The necessary negotiations for material and labor which, in the ordinary course of events, would take several months, were completed in less than a year and a half and put into operation.

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A flying
dress salesman

THREE weeks shopping in Alaska need not be mentioned to find the native women dressed in the latest Paris styles. Since conditions of travel make it impossible for the Indian and Eskimo to buy the latest styles, the Indians and Eskimos of the larger cities, such as Anchorage, Juneau and Fairbanks, travel to Seattle where the packages are mailed to them by air.

The Indians and Eskimos of the Fairbanks division of Unalakleet Air Lines, arriving at Newark Airport, the package was handed by truck to the Pennsylvania Railroad where a special messenger picked it up and transported it to the passenger train to New York City.

Frequently news items arrive at the Newark Airport at night, and in such cases a laboratory fire must be kept

in hand at the station at an overtime cost of \$300 an hour, to be ready to go to work on the package. Under these conditions any delay results in real financial loss. The laboratory arrangements are made at the "Flying Doctor Shop." By carefully watching his costs with the pay-off periods at the various stations, Mr. Colman is able to catch his customers in a spending mood. Only through the use of the airplane model can he afford to obtain the price realization. [Courtesy of *The American Weekly*, Oct. 7, 1952.]

Airplanes aid
Czech food industries

PROFITABLE exchange of cornmeal, wheat flour and the agricultural products of Italy, Paris, Amsterdam and London, and the Soviet Union, and other parts of Europe, are the chief factors in the part payment by the Czechoslovak airlines. The airplane carry warehouse, an important product of the country, to Berlin and London at an established rate of \$700 per ton per kilogram, is transported. On the return trips to Prague, the ships carry lobsters, oysters and other sea foods which are at a premium in the landlocked territories of Czechoslovakia. In the past, the range of exports of fresh mushrooms has been extended by their perishable nature.

Anteigiro
sky ads

SEVERAL effective advertising campaigns have been conducted recently over a number of Eastern cities by the use of large model planes, the "Kite Aeroplanes." The free flights are of sufficient novelty to attract attention, and the banner from 150 to 200 ft. long, carrying letters 9 ft. high, exciting about 400 ft. behind the plane moves very effectively the advertiser's copy.



A new form of air writing.

THE BUYERS' LOG BOOK

Welder's truck

A new proposed truck for the handling of oxygen and acetylene tanks in welding shops has recently been introduced by the Little Air Products Company, Division of the Proctor-D-Wall-Puritan division. The Little Ma 5 truck increases the ease and convenience of moving a welding or cutting outfit from place to place, and saves a few required for the oxygen and acetylene cylinders, eliminating possibility of overturning them due to bumping the truck or jolts. The frame is of angle iron with a steel plate floor and steel side handles. The handles, being locked in place, may be easily removed for shipping or storage. Adjustable shores hold the cylinder in place on the truck. It weighs 125 pounds and can travel at 5 miles per hour.



Ma 5 Welding cylinder truck

airplane. A water hoist attachment for Clevite starters is being manufactured by the Service Hoist Company. A 6-ft. sight hoist is rotated under power at 150 rpm. is mounted on a yoke bolted to the front end of the tractor. A lever system permits raising the hoist out of the way when not in use. Due to the rapidity of the hoist's vertical movement, all dust and snow are removed in one pull, leaving a clear path for the tractor.—AVIATION, December, 1932.

Humidity control

R ECENTLY John P. Frost & Son's, Inc., a division of Borden Aviation Corporation, has announced an addition to the line of instruments for recording and controlling temperature and humidity. The new Frost hygrometer is a control device intended to maintain a constant relative humidity in industrial processes, for example, in dyes and fabric shops, by turning on or off of suitable water sprays through a relay system. Specially prepared humectant holes are used as hygrometer elements. A heating coil is provided, which can be set at a variable rate to maintain any humidity throughout a range from 25 per cent to full saturation.—AVIATION, December, 1932.

Re-threading dies

B RUISED and battered threads re-used or new may be quickly restored to their original condition by means of a new series of "slip-on" re-threading dies recently introduced by the Groundfield Tap & Die Corporation. These that resemble an ordinary round die split in two halves and are held together by the tension of a flat spring around each half. Any die may thus be opened up slightly so as to be able to be re-threaded. This is done by first over the die, and the latter clamped as plain by adjusting two screws. The



The Little Air Products tank truck

Four pillar radio tubes

D ESIGNS especially for use under vibration conditions. Recently Raytheon tubes are now being manufactured as an aircraft radio tube by the National Carbon Company, Inc. The distinguishing feature of these tubes is the mounting of the tube elements on four separate pillars, so that there are two pillars per element. It is claimed that this method of construction gives greater strength and rigidity, and protects the sensitive elements from the vibrations caused by mechanical shock and vibration. These tubes are available in the standard sizes of 4, 6, and 8, as detectors, amplifiers and oscillators.—AVIATION, December, 1932.

Radio beacon trainer

LIEUT. COL. WALTER J. CRANE,貫前人，of "Mud Flight" in Theory and Practice, has developed equipment to simulate radio beacons. In many locations it is impractical to locate extensive training areas because of a lack of suitable terrain. While the "radio beacon" is not yet, however, the simulator or check pilot can set up all types of beacon and Mud landing problems.

The device consists of a sending unit which may be mounted in any convenient place in the cockpit floor; a receiver consisting of a vacuum flight indicator, as well as a park rate gyro which the student's header may be phugoid; and a control panel to be mounted in the instructor's cockpit. By manipulating a few simple switches and rheostats, the instructor can simulate any type of mud landing at any velocity desired. The device need a simple to install and operate.

It is being manufactured and distributed by Hanger Six, Inc., Whidbey Field, San Antonio, Tex.—AVIATION, December, 1932.

Snow sweeper

T HE approach of winter brings up the snow removal problem at many

Flying from
Floating Fields

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Marlin-Rockwell Corp.

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See plane Color Illustration
(page 10) and specification
with Wright J-5 Series "A"
Engines developing 300 h.p.

High Speed	130 m.p.h.
Cruising Speed	112 m.p.h.
Descent (at sea level)	10 ft. per sec.
Service Ceiling	16,000 ft.
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Spans	37 ft. 4 in.
Wing Area	53 sq. ft.
Useful load	1,000 lbs.
Passenger容積	125 lbs.
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Fuel and payload	1,225 lbs.

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Pratt & Whitney J-5, 300 h.p.; Wright "A" 300 h.p.; Wright "B" 300 h.p.; Pratt & Whitney J-5, 300 h.p.

THE BELLANCA AIRBUS

See plane Color Illustration
(page 10) and specification
with Pratt & Whitney "Wasp" Engine
developing 420 h.p. at 4,200 ft.

High Speed	151 m.p.h.
Cruising Speed	131 m.p.h.
Descent (at sea level)	10 ft. per sec.
Service Ceiling	16,000 ft.
Wing Area	53 sq. ft.
Spans	37 ft. 4 in.
Useful load	1,000 lbs.
Passenger容積	125 lbs.
Oil	100 lbs.
Fuel and payload	1,225 lbs.

Above performance with Wright "Cyclone" Bearing "T" Engine, developing 300 h.p., plane also available with Pratt & Whitney "Wasp" J-5, 300 h.p. or Pratt & Whitney "Wasp" Super, 300 h.p.

THE BELLANCA SKYROCKET

See plane Color Illustration
(page 10) and specification
with Pratt & Whitney "Wasp" Engine
developing 420 h.p. at 4,200 ft.

High Speed	151 m.p.h. (at 6,000 ft.)
Cruising Speed	131 m.p.h. (at 6,000 ft.)
Descent (at sea level)	10 ft. per sec.
Service Ceiling	16,000 ft.
Wing Area	53 sq. ft.
Spans	37 ft. 4 in.
Useful load	1,000 lbs.
Passenger容積	125 lbs.
Oil	100 lbs.
Fuel and payload	1,225 lbs.

Above performance with Wright "Cyclone" Bearing "T" Engine, developing 300 h.p., plane also available with Pratt & Whitney "Wasp" J-5, 300 h.p. or Pratt & Whitney "Wasp" Super, 300 h.p.

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"The dead take
to their graves, in their
clutched fingers, only that
which they have given away"



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The Welfare and Relief Mobilization for 1933 is a cooperative national program to reinforce local hand-raising for human welfare and relief needs. No national fund is being raised. Each community is making provision for its own people. Each community will have full control of the money it obtains.

Read again the great words attributed to Rousseau which are printed at the top of this page. Then give through your established welfare and relief organization, through your community chest, or through your local emergency relief committee.

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We judge this fact as one example of leadership.

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We regard this fact as further evidence of leadership.

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THE WACO AIRCRAFT COMPANY, Inc., St. Louis



"AIRCRAFT FIRST"

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Fig. 1635

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AVIATION
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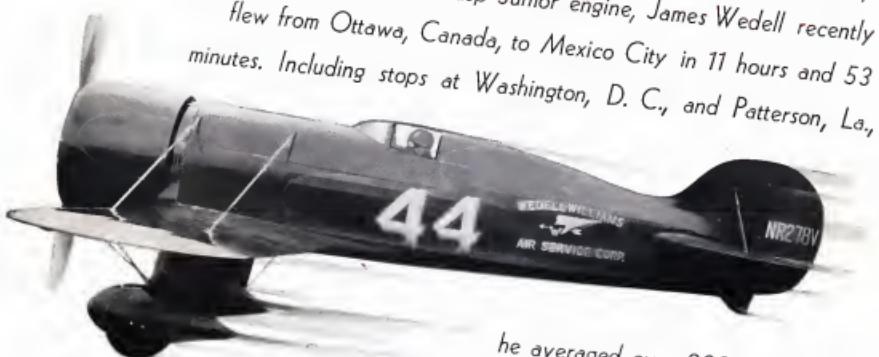
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